

VERTEBRAL TUBERCULOSIS - A CLINICAL STUDY

-oOo-

I. INTRODUCTION.

Percivall Pott first described a disease of the vertebral column, which is characterised by erosion and destruction of the bodies of the vertebrae. It is liable to produce an angular deformity of the spine, and to be associated with abscess formation and with nervous symptoms referable to pressure on the cord. This disease is now known to be tuberculous. According to Ridlon in a typically American article entitled "The Man who potted Pott" Pott's publication was preceded by a report from Jean Pierre David, apparently dealing with a case of tuberculous spine. The priority, however, is generally conceded to Pott.

(18)
The first of Pott's two pamphlets upon that condition of the spinal column now called by his name was published in 1779. It is entitled "Remarks on that kind of Palsy of the Lower Limbs which is frequently found to accompany a Curvature of the Spine and is supposed to be caused by it."

(1)
The second pamphlet by the same author was issued three years later, in 1782, under the title: "Farther Remarks on the useless state of the Lower Limbs in consequence of a Curvature of the Spine, being a supplement to a former treatise on that subject." This pamphlet is illustrated by

six engravings, showing the changes which take place in the vertebrae as a result of the disease.

The first pamphlet may be said to deal with the clinical features of the disease, the second with the morbid anatomy. After dedicating his work to one of his teachers, Pott goes on to say: "The disease of which I mean to speak is generally called a palsy, as it consists in a total or partial abolition of the power of using, and sometimes of even moving, the lower limbs, in consequence, as is generally supposed, of a curvature of some part of the spine. To this distemper both sexes and all ages are equally liable and until the curvature of the spine has been discovered, it generally passes for a nervous complaint..... I have in compliance with custom called the disease a palsy yet there are some essential circumstances in which this affection differs from a common nervous palsy: the legs and thighs are rendered unfit for all the purposes of locomotion, and do also lose much of their sensibility, but they have neither the flabby feel which a truly paralytick limb has, nor have they that seeming looseness of the joints, nor that total incapacity of resistance, which allows the latter to be twisted in almost all directions. On the contrary, the joints have frequently a considerable degree of stiffness, particularly the ancles, by which stiffness the feet of children are generally pointed downward, and they are prevented from setting them flat

upon the ground. The curvature of the spine, which is supposed to be the cause of the complaint, varies in situation, extent, and degree, being either in the neck or back, and sometimes (though very seldom) in the upper part of the loins; sometimes comprehending two vertebrae only, sometimes three or more but whatever may be the number of vertebrae concerned, or whatever may be the degree or extent of the curvature, the lower limbs only feel the effect at least I have never once seen the arms affected by it."

Pott's disease is now recognised to be the most common form of surgical tuberculosis, and, apart from its frequency, it is a very crippling disease, with comparatively high mortality figures. Also the length of time required for its successful treatment entails much loss of efficiency, no matter at what age it has attacked its victim.

My interest in the subject was first aroused by a "run" of cases met with in the ordinary course of general practice. These cases were all sent to the Orthopaedic Hospital at Millport under the care of Dr. Paul, by whose kindness I have been enabled to follow up these and other cases of Pott's disease, and have become familiar with the routine and lines of treatment followed in Millport. He has very kindly placed his case records at my disposal, and I hope in the following pages to be able to add some facts of interest and value to our knowledge of the pathology and

treatment of this condition.

I propose to start with a short account of the anatomy of the vertebral column, and the pathological changes caused by the disease, with some reference to the mode of spread to the spine from the primary tuberculous focus.

I next wish to consider the etiology of the disease, and follow this by a description of its symptoms and signs.

Diagnosis and prognosis must then be considered, with special reference to the changes in the latter from modern advances in treatment.

I then wish to consider treatment, both general and local, the latter rather fully, with special reference to the various schools of thought, and the cycle of changes through which treatment has passed since the days of Pott. I wish to attempt to assess the relative values of conservative and operative treatment, and the various types of operations performed, and finally to outline what seems to be the halfway house of contemporary thought and practice.

I wish to give a detailed description of representative cases at the different age periods at which the condition is met, with accompanying radiograms, and photographs.

Finally I wish to pick out the important points in the thesis, and work them into a brief summary, embodying the conclusions I have reached in my study of Pott's disease.

I shall indicate in a Bibliography the works of others referred to in the thesis, each quotation being indicated

by a number corresponding to the number in the Bibliography.

Fifth Dorsal Vertebra

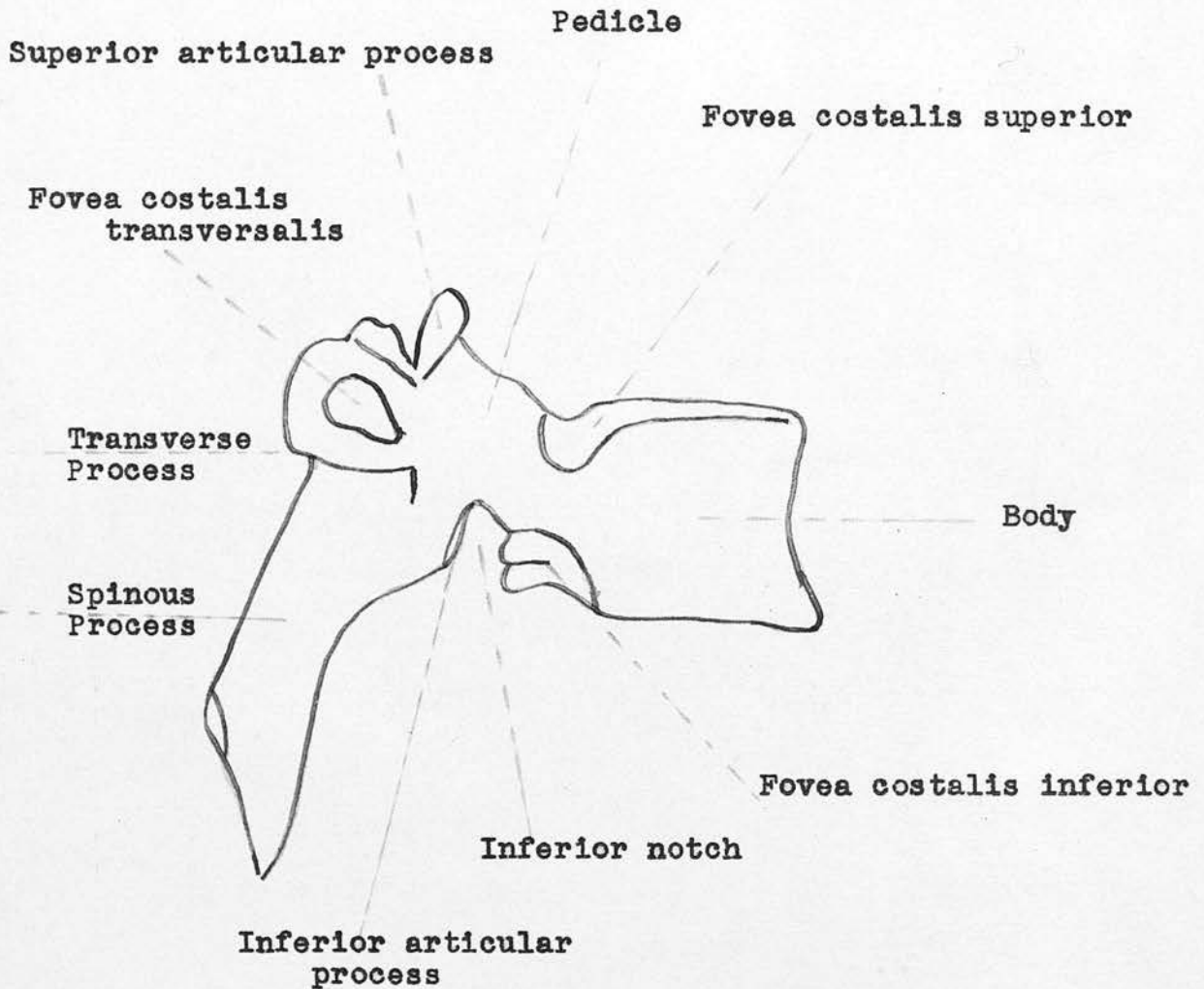


FIGURE 1 A

.ANATOMY OF VERTEBRAL COLUMN.

The vertebral column in man consists of thirty-three
(2)
superimposed segments or vertebrae grouped according to
regions.

- (a) Movable or true vertebrae:- 7 cervical, 12
dorsal, 5 lumbar.
- (b) Fixed or false vertebrae:- 5 sacral, fused
in the adult to form the sacrum, 4(3-5) coc-
cygeal, fused to form the coccyx.

The common characters of vertebrae are seen best in the
mid-dorsal region.

(3)
A typical vertebra may be described as consisting of
a body composed of a mass of spongy bone, more or less cyl-
indrical in form. The superior and inferior surfaces af-
ford attachment for the intervertebral discs, which are
placed like pads between the bodies of the movable members
of the series. The vertical surfaces of the body are pier-
ced here and there by foramina for the passage of nutrient
vessels.

Connected with the body posteriorly there is a bony
vertebral arch which, by its union with the body, encloses
a foramen, called the vertebral foramen (Fig.1, A and B).
When the vertebrae are placed on the top of each other these
foramina form, with the uniting ligaments, a continuous
canal, the vertebral canal, in which the spinal cord, with
its coverings, is lodged.

Fifth Dorsal Vertebra

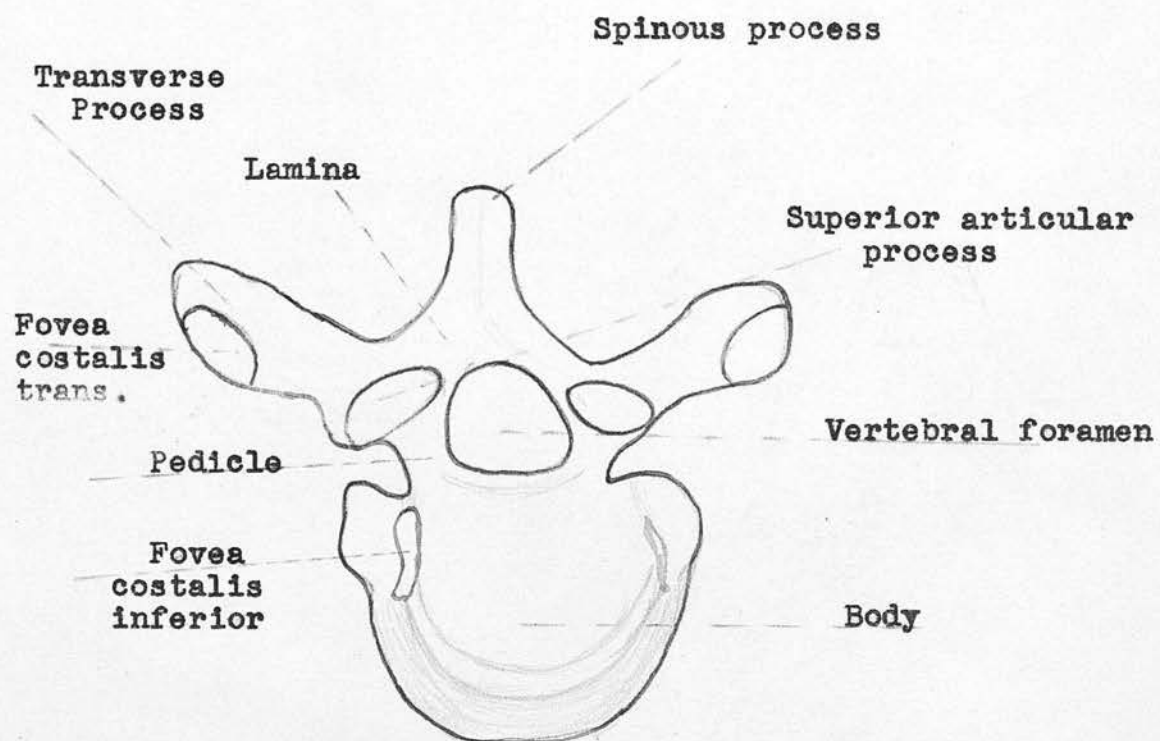


FIGURE 1 B

The vertebral arch, which is formed by the union of the pedicles and the laminae, besides enclosing the vertebral foramen, also supports the spinous and transverse processes, which may be regarded as a series of levers to which muscles are attached, while others are articular, and assist in uniting the different vertebrae together by means of a series of movable joints.

The pedicles are the bars of bone which pass from the dorsum of the body of the vertebrae, one on each side, to the points where the articular processes are united to the arch. When the vertebrae are placed one above the other, a series of intervals is left between the pedicles of the different vertebrae.

These spaces form a series of holes communicating with the vertebral canal, and are called the intervertebral foramina, and allow the transmission of the spinal nerves and vessels.

Posteriorly the two pedicles are united by the laminae, which converge towards the median plane and become fused with the root of the projecting spinous process. Their borders and internal surfaces are rough for the attachment of the ligamenta flava.

The laminae leave little space between them, thus enclosing fairly completely the vertebral canal, of which they form the posterior wall.

The muscular processes are three in number, viz. two

The Atlas from above.

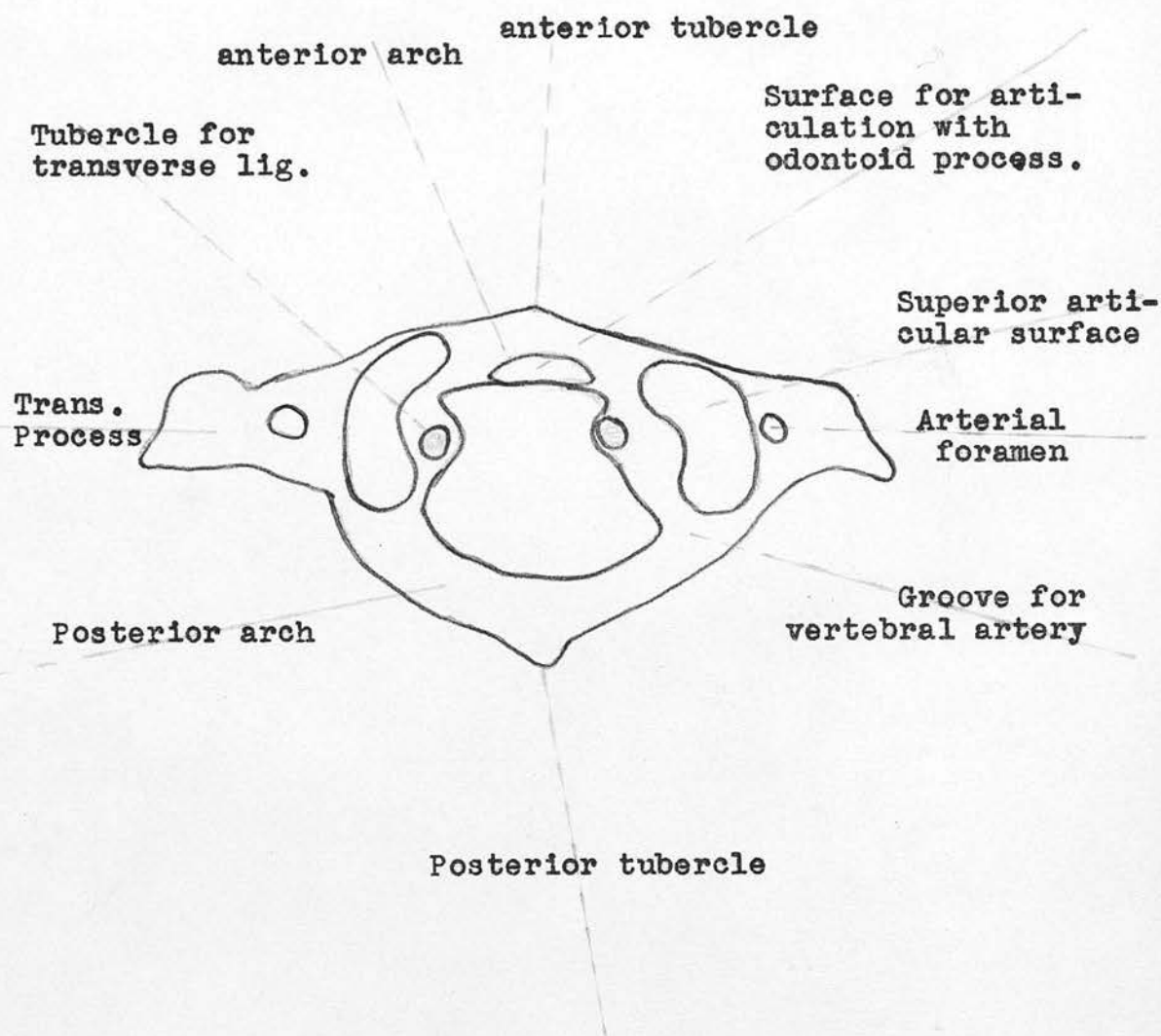


FIGURE 2.

transverse processes, one on each side, and one central, the spinous process. The transverse processes project laterally on either side from the arch at the point where the root of the pedicle joins the lamina. The spinous process extends backwards in the median plane from the point of fusion of the laminae.

The articular processes, four in number, are arranged in pairs, one superior, the other inferior. The former are placed on the upper part of the arch where the pedicles and laminae join, the latter in the lower part of the arch in correspondence with the superior.

Cervical Vertebrae.

Special character. The transverse process enclosed a foramen called the foramen transversarium. A typical cervical vertebra has a body which is small and elongated transversely, pedicles which are short and rounded, laminae long, narrow and sloping, vertebral foramen large, triangular or semilunar, spine short and bifid, transverse process short and encloses foramen, is bifid, ending in two tubercles, anterior and posterior; the articulating surfaces of the articular processes are nearly circular.

Special Cervical Vertebrae.

I. Atlas or 1st Cervical Vertebra has no body and no spine (Fig.2). It consists of two lateral masses united by an anterior and posterior arch. The anterior arch has a cir-

Axis from behind and above.

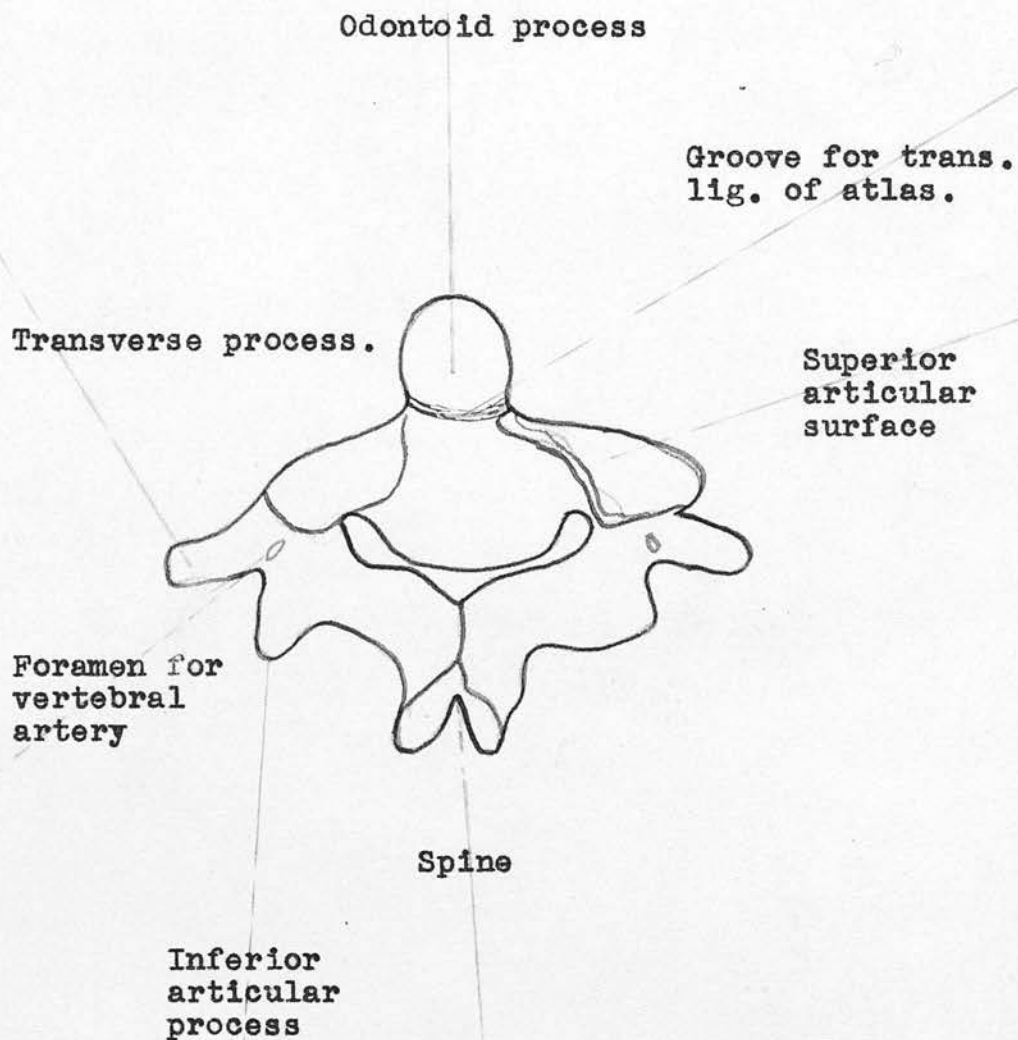


FIGURE 3

cular facet - the fovea dentis - on the posterior surface for articulation with the odontoid process of the 2nd vertebra, and a small anterior tubercle on the anterior surface. The posterior arch is much longer than the anterior. It has a groove for the vertebral artery and the 1st cervical nerve on its upper surface, near the lateral mass; and a small posterior tubercle on its posterior surface, in the median plane. The transverse process projects from the lateral side of the mass.

II. Epistropheus (Axis) or 2nd Cervical Vertebra (Fig.3)

Distinguished by a tooth-like projection from the upper surface called the odontoid process, which presents a facet on its anterior surface for the anterior arch of the atlas. The spine is stout, broad and bifid, the transverse process is small.

Thoracic Vertebrae.

Special characters: Facets on the sides of the bodies for the heads of the ribs, and facets on the transverse processes for the tubercles of the ribs.

Lumbar Vertebrae

Distinguished by their large size, by the absence of foramina in their transverse processes, and by the absence of costal facets.

Sacrum.

The sacrum is roughly triangular in shape, possessing a

base or upper surface, an apex or lower end, dorsal, pelvic, and two lateral surfaces. It is divided, on both dorsal and ventral surfaces, by two series of foramina, into a median portion, composed of most of the parts of five fused vertebrae, and two lateral masses, composed of the fused costal elements and transverse processes.

Coccyx.

The coccyx is triangular in shape, with the apex downwards. It is formed almost entirely of the rudimentary bodies of four vertebrae, which tend to fuse.

The Vertebral Column as a Whole.

It is 28 inches long in the male, nearly 24 in the female. The superimposed bodies form a column for the support of the trunk and the head. The vertebral foramina provide a canal for the spinal cord and its membranes. The spinous and transverse processes form three interrupted ridges bounding two vertebral grooves of which the laminae form the floors. They are occupied by muscles which move the column.

Viewed from the Side, the bodies form four curvatures, cervical and lumbar anteriorly, dorsal and sacro-coccygeal concave anteriorly.

The dorsal and sacro-coccygeal curves are present in the foetus and are called primary.

The cervical curve results from elevation and extension

Mesial section through a portion of
the lumbar part of the
vertebral column

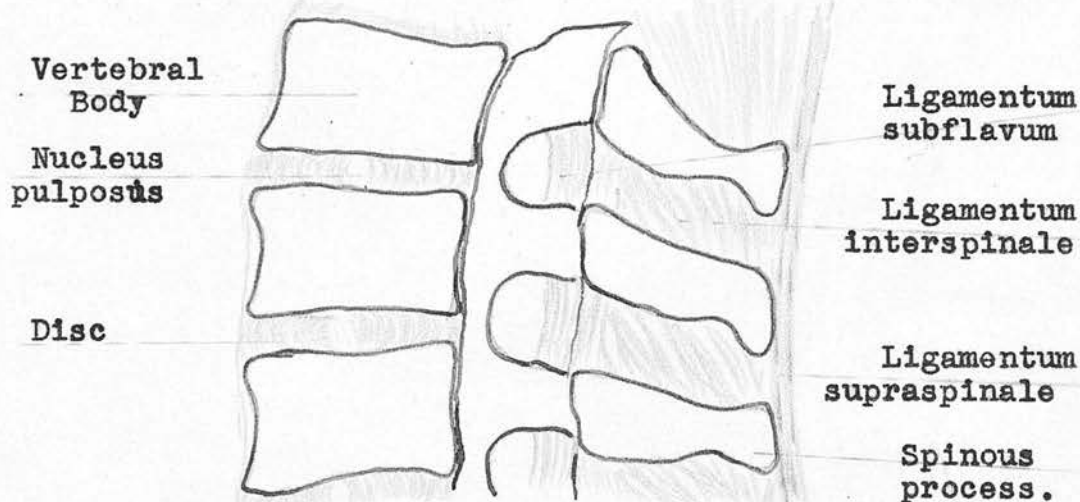


FIGURE 4

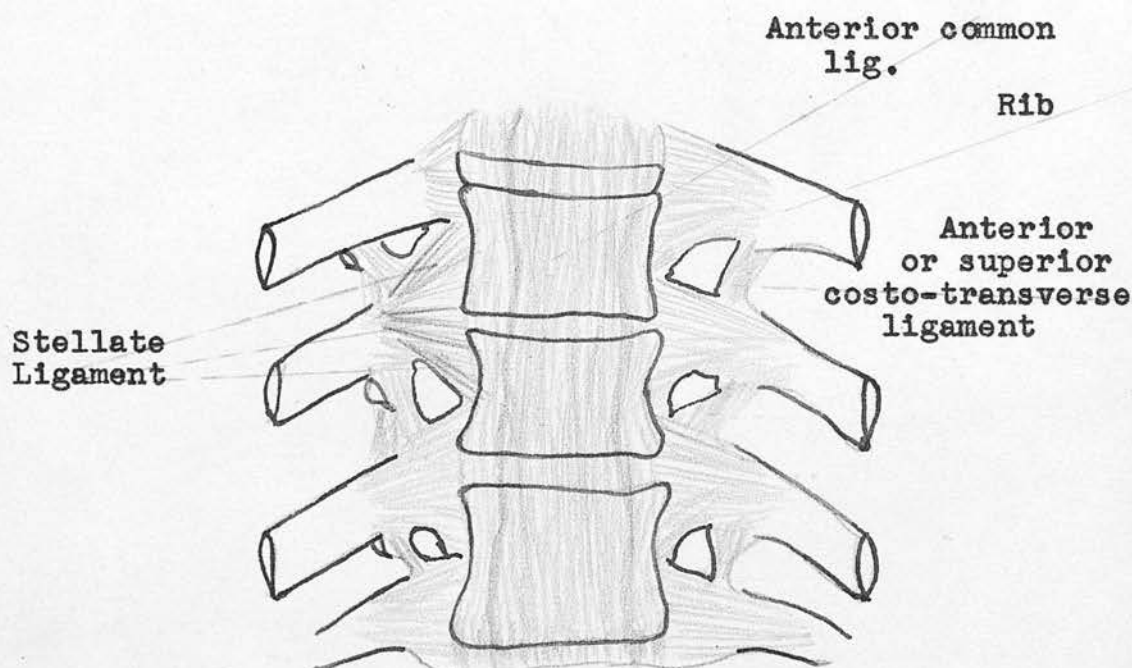


FIGURE 5

Anterior common ligament of the vertebral
column and the costo-vertebral
joints as seen from
the front.

of the head in infancy; the lumbar from the assumption of the erect attitude when the child begins to walk. These are called secondary or compensatory. They are due chiefly to the shape of the discs.

The cervical curve can always be undone by flexing the neck, the lumbar curve cannot be undone in adults.

Viewed from the Front, sometimes there is a slight lateral curvature in the dorsal region, convex usually to the right, with above and below slight compensatory curves in the opposite direction.

Joints and Ligaments of the Vertebral Column.

I. Between the Vertebral Bodies (Figs. 4 and 5).

(1) Intervertebral Discs are firmly attached to the upper and lower surfaces of the vertebrae. Each disc consists of a circumferential portion, the annulus fibrosus, formed for the most part of oblique parallel fibres running from one vertebrae to the other; horizontal fibres are also found. The axial or central part of the disc, the nucleus pulposus, is elastic, soft and pulpy. They contribute largely to the cervical and lumbar curvatures, and form one quarter of the length of the vertebral column.

(2) The anterior common ligament and (3) the posterior common ligament are attached to the discs and margins of the bodies. They lie on the anterior and posterior surfaces of the bodies respectively, and extend from atlas to

sacrum.

(4) Articular capsules surround the small diarthrodial joints between the lateral parts of the bodies in the cervical region.

II. Between the Vertebral Arches.

(1) Articular capsules connect the articular processes and surround the diarthrodial joints between them.

(2) Ligamenta subflava consist of yellow elastic fibres and are attached to the inner surface and lower border of the lamina below. They are seen, therefore, from within the vertebral canal. They are connected with the capsule laterally; the medial edge of each is thickened and separated from its fellow by a small interval filled with fatty areolar tissue.

(3) Interspinous ligaments are attached to the contiguous spines, from base to tip.

(4) Supraspinous ligament is attached to the tips of the spines, along the whole length of the column. It is strongest in the neck, where it forms the ligamentum nuchae, a triangular sheet between the muscles of the two sides of the back of the neck.

(5) Intertransverse ligaments, very weak. Connect the transverse processes.

(8) Blood Supply of the Vertebrae.

The anterior portion of the vertebra is supplied by

multiple small vessels entering into the body of the vertebra from the anterior common ligament. The body of the vertebra itself is supplied by a pair of comparatively large arteries entering into the posterior part of the vertebral body and supplying most of the body substance.

A third pair, also coming from the posterior branches, takes an upward and downward course and ends in the epiphyses of the vertebra.

The arterial supply of the neural arches is represented by a pair of arteries which enter into the bases of the transverse processes. These arteries supply the pedicles, the neural arches, the transverse and spinous processes.

PATHOLOGY.

Tuberculosis of the spinal column, in common with the majority of tuberculous bone lesions, is essentially (4) a local evidence of a pre-existing infection.

There has been a portal of entry, one, it may be, far distant from the site of the vertebral disease, and from this primary focus there has been an infection of the blood stream or the lymph stream, by which the organisms have been carried and finally deposited in the vertebral site.

Mechanism and Routes of Infection.

(1) The sequence of events is reasonably assumed to be as follows. The individual comes in contact with a tuberculous infection. There is absorption of the organism through certain selective areas of the respiratory or intestinal mucous surfaces, tuberculous disease of the related lymphatic glands ensues, and, thereafter, or it may be independently of the lymphatic disturbance, there is an invasion of the blood stream, through which channel the ultimate dissemination of the disease is conveyed.

This is the commonly accepted view of the mode of spread, following the classical work of Lexer, Tuliga and (5) Turck. The vertebra is a short bone. Its blood supply is mainly derived from the nutrient vessel which enters the posterior surface of the body, a small amount is distributed to the interior from the periosteal supply, while minor

individual vessels supply the accessory processes and the intervertebral discs. The arrangement of the central artery favours the embolic type of infection, which is supposed to originate the tuberculous invasion, for almost immediately after its entrance into the bone it breaks up into a complex and tortuous distribution, thus constituting ideal conditions for the arrest and development of a tuberculous thrombus. The presence of large stagnant lakes of blood within the body of the vertebrae helps to explain the fact that tuberculosis of the spine is the most common type of bone tuberculosis. ⁽⁶⁾

(2) There is a possibility of direct infection of the spine from open wounds, but this must be very exceptional.

(3) In spite of the more or less general acceptance of the blood-borne type of infection, there are some who believe in the lymphatic system as the route by which the infection takes place. ⁽⁶⁾ Fraser has recently drawn attention to this theory. He states that, out of a series of one hundred cases of tuberculosis of the spine taken from the records of the Sick Children's Hospital, Edinburgh, ⁽⁴⁾ in which the site incidence was distributed over an area from the 2nd dorsal to the 3rd lumbar vertebrae, no fewer than fifty-one were located in a segment embracing the 10th, 11th and 12th dorsal and the 1st lumbar vertebrae.

The classical explanation of the predilection of the infection for the dorso-lumbar junction in particular de-

depends on the comparatively large extent of cancellous tissue in this situation, and the degree of weight-bearing and of movement demanded by this portion of the spinal column.

Fraser criticises this theory owing to the fact that it is a very difficult matter to reproduce Pott's disease by infecting the blood stream, showing that cancellous tissue of bone is peculiarly resistant to a primary tuberculous infection.
(7)

He draws attention to the fact that the lymphatic system is the route and vehicle of tuberculous infection, that the lymphatic vessels and nodes are the primary vehicles and sites of infection, and that a blood infection is a secondary phase to a primary involvement of the main lymphatic trunks. He also states that a tuberculous infection is intimately associated with degenerative changes in bone marrow, and that the normally resistant cancellous bone tissue of the vertebrae undergoes degenerative changes, which predispose it to tuberculous infection, owing to the fact that the thoracic lymphatic duct is virtually in contact with the anterior surface of the vertebral column, separated from the compact surface bone by the anterior common ligament.

Fraser suggests that there may be a direct infection of the vertebral body from the overlying duct and its related lymph areas, and that in the area of maximum incidence

as described above is the field into which the great bulk of the abdominal lymphatics collect, and that it is the abdominal lymphatics and nodes through which the primary infection gains entrance.

In the past Fraser thinks we have underestimated the importance of the prevertebral lymphatic tissue as a means both of direct infection of the vertebrae, and of being productive of those secondary changes in the cancellous tissue of the vertebral bodies which predispose the area to the later development of a true tuberculous focus.

The Sequence of Pathology.

The individual tissues which compose a vertebra are those common to any bone - the lamellae, compact or cancellous, the marrow, the periosteum, and the blood vessels.

In association with a tuberculous infection, each of these structures shows distinctive changes, and each change plays an important part in the ultimate clinical picture. ⁽⁴⁾

The original focus and the genesis of the various secondary changes is the tuberculous follicle. Set in the cancellous tissue, it grows and extends by processes of reduplication and confluence, until it becomes of a size appreciable to the naked eye as a greyish-yellow infiltration spreading throughout the marrow. Coincident with the early deposit of the disease, highly significant reactions begin to appear in the various individual tissues

of the bone, and the ultimate picture is partly dependent upon these secondary phenomena.

The marrow changes consist in a progressive disappearance of the red marrow so that the interlamellar cancellous spaces are pale in appearance, because they are occupied by a fibro-connective tissue interspaced among fat cells. The change is essentially the introductory phase of a protective mechanism, the first stage of a fibrosis designed to limit and to localise the tuberculous element.

The reactions in the bony lamellae are of peculiar significance. The position of the average vertebra is such that it is called upon to bear a greater degree of strain in proportion to its size than perhaps any other bone. The strength of the bone depends not so much upon the compact tissue of its surface as upon the interlacing and strut-like characters of the multitude of plate-like lamellae which occupy the interior; remove these, and the vertebral body is like a house of cards, incapable of bearing any appreciable degree of superincumbent weight.

A very interesting and important point in the changes which take place is the absence of periosteal reaction. When tuberculosis affects a long bone a periosteal reaction and the deposit of subperiosteal bone is one of the most striking features. The phase is in itself a welcome one, for it is obviously a salutary phenomenon in so far as it prevents the eruption of the disease into the soft parts,

and at the same time supports and strengthens the underlying and weakened bone. It is significant that the vertebra does not show the change in any degree. There is evidently some osteogenetic factor in abeyance, but the absence of the subperiosteal sheath is in some respects the key to the later pathology, for, had it been present, it would in some measure have supported and buttressed the underlying and weakened bone.

Vascular changes also follow. A variety of endarteritis obliterans is a constant accompaniment of a tuberculous lesion, and it is most characteristically seen in the vessel which is the direct supply of the area containing the tuberculous focus. This change is manifest in the main nutrient vessel of a tuberculous vertebra, sometimes so marked that the vessel outline may be apparent in an X-ray. It is a significant change. Its development means a progressive diminution in the blood supply of the part, and this in turn is reflected in a lowering of the local resistance and a further development of those degenerative changes in the marrow.

The vascular change is probably a factor of considerable importance in the ultimate progress of the disease. In considering the pathology of Pott's disease of the spine, two main considerations must be kept in mind.

(A) The situation of the lesion.

(8)

(B) The special pathology.

the anterior common ligament. At first the intervertebral disc is spared, but with the disease spreading to the adjacent vertebrae the cartilage is disattached from either side, becomes disintegrated and finally disappears. Bone bridges from osteophytic formations are observed reaching from one vertebra to the other. When fusion finally does occur in the central type the collapse of the vertebrae under the stress of the superincumbent weight has already taken place, and the characteristic posterior deformity has made its appearance.

Symptoms usually only appear after collapse of the body has taken place. There are few symptoms in the early stages of the disease.

(2) The anterior peripheral form. In this type the anterior portions of the body under the anterior common ligament are affected. This part of the vertebra derives its blood supply from the intercostal and lumbar arteries, reaching the body through the anterior common ligament. The infection spreads underneath the ligament, and, as a rule, remains superficial. Not infrequently, however, it penetrates into the body, and then becomes identical with the central type which leads to the destruction of the vertebral body. This type is also produced by contact infection from tuberculous abscesses originating in neighbouring vertebrae. As the central form, this type also develops either as a fungus with all signs of tuberculous new for-

mation, or as a caseating form, producing superficial erosions at the anterior surface of the body especially round the blood vessels. The nutrient foramina appear enlarged and eroded, giving a worm-eaten appearance of the anterior surface. This type is, according to Krause, the most common form of adult spinal tuberculosis. Deformity in this type sets in very late. In Doub and Badgley's series of one hundred cases, there were 8 cases of the anterior peripheral type, but only 2 were purely anterior. The other 6 showed anterior involvement, but were seen in combination with the other types. (9)

(3) The epiphyseal type. The articular margins of the vertebrae are supplied by the epiphyseal arteries, which are branches of the posterior spinal artery, and it is through these arteries that infection takes place. In this type, the infection begins along the articular margins of the vertebral body and consequently there is early involvement and destruction of the intervertebral disc. Narrowing of the disc is one of the earliest X-ray signs in this type. There is also early involvement of the adjoining vertebral articular surface. Abscess is also commonly found early in the course of the disease. Symptoms usually occur while the disease is still in its early stages and therefore Doub and Badgley found many more early cases of this type in their series than of the central type.

As the disease progresses, there is gradual excavation

from the articular surface toward the central portion of the vertebral body. The destruction may also extend to the anterior portion of the vertebra, and, when this point is reached, there is generally collapse of the vertebral body as was noted in the central type. Collapse of the vertebra in this type is unusual. In the series mentioned only 10% of the cases with this type of infection showed collapse.

In cases which are diagnosed and properly treated early in the course of the disease, there is healing with very little deformity in the shape of the vertebral bodies, and in favourable cases they may even heal without the bodies becoming fused. In cases further advanced they become fused in a more or less parallel manner with very little external deformity. * Recently some doubt has been expressed as to whether there is an epiphyseal type at all, and it is suggested that the infection begins in the disc itself, not in the epiphysis.

(57)

Schmorl has done pioneer work in the anatomy and pathology of the intervertebral disc, and Ross Smith (58) has recently reported a detailed study of the disc. He states that in the nucleus pulposus he discovered a central cavity, and in many cases there were villi projecting into it from the wall. The villi were cellular, and of irregular size and shape. He also found evidence of nutritive channels in the disc. It had been thought previously that nourish-

* New paragraph.

ment was provided by diffusion currents from the spongiosa of the vertebrae. These nutritive channels come from the marrow of the vertebral bodies, and pierce the cartilaginous plates of the disc, passing thence between the fibres of the annulus fibrosus, and reach the nucleus pulposus.

The fact that blood vessels exist in the disc, and pass to the nucleus pulposus, which contains a cavity with cellular villi present in it, makes it very likely that infection could occur in the disc either as the first focus or coincident with the infection of the vertebra.

This would explain the fact that in a number of cases the radiogram shows definite involvement of the disc without any evidence of involvement of the vertebra. It is therefore probable that in a certain number of cases at least the focus originates in the disc and spreads to the body later.

(8)
(4) Tuberculosis of the neural arches and pedicles. These structures are less suitable for the establishment of a tuberculous focus, since they consist mainly of compact bone. Formation of small sequestra and of abscesses penetrating between the dorsal muscles to both sides of the spine has been observed. Compared with the involvement of the body, tuberculosis of the pedicles, of the articulations and neural arches, as well as of the transverse processes, is of rare occurrence. When arches or pedicles

are involved on one side, an asymmetrical destruction of the vertebral substance results which causes a true lateral deformity. Not uncommonly this lateral deformity is combined with antero-posterior gibbus. The involvement of the articular processes of the vertebrae in the tuberculous process is extremely uncommon, except for the articulation between the 1st and 2nd cervical vertebrae. This latter localisation develops a characteristic clinical picture known as suboccipital tuberculosis.

(5) Suboccipital tuberculosis or Malum Vertebrale. Under this term is included tuberculosis located in the atlanto-occipital, and in the atlanto-odontoid articulation. It is a distinct clinical entity, known also under the name of Rust's disease. ⁽¹⁰⁾

Suboccipital tuberculosis is relatively rare; more common in children, seldom seen in advanced age, its most frequent occurrence falls between the fifteenth and twenty-five year ⁽¹¹⁾ (in 46% of all cases). The disease is not limited to one joint, but gradually involves all joints between occiput, atlas and axis, leading to more or less destruction of the body substance. It develops as either an osseous or synovial form, producing erosion and caseous destruction of bone, detachment and subsequent disintegration of the joint cartilage and extension of the inflammatory process into the spinal canal. Not infrequently the odontoid process sequesters and becomes detached from its base.

(6) Tuberculosis of the transverse process. This is extremely rare. B.H.Moore reports a case of fracture of the transverse process of the 4th lumbar, due to tuberculosis.
(12)

(7) Tuberculosis of the spine of the vertebra. This is also a very rare occurrence. Case I of the present series showed involvement of the spine of the 4th cervical vertebra on admission, with no apparent involvement of the body. Later the infection spread to the body of the vertebra, and to the spine of the 5th cervical vertebra.

B. The Special Pathology.

In the different pathological types which we meet with in tuberculosis of the spine there are some essential features common to all. The local hyperaemia incident to the localisation of tuberculous material, the immediate tissue reaction with round cell infiltration and extravasation of leucocytes from the capillary system, the formation of primary miliary tubercles with epithelial and giant cells, the development of granulation tissue, are characteristic findings for each and all of the different forms. There is, however, a difference in the degree of the reaction of the tissue according to the virulence of the infection, according to the manner in which the inflammatory process extends and according to the degree in which reparatory changes appear. In other words, the formation and extension of abscesses, the greater or lesser extent of bony

destruction, and correspondingly greater or lesser tendency to deformity, the ability to form bony callus or fibrous scars, determine to a great measure the clinical course.

TYPES.

I. Caries Sicca: dry type of tuberculosis.

The new vascularisation progresses rapidly with the formation of granulation tissue. The trabecular bone becomes rarified and melts down, but the virulence of the infection becomes exhausted comparatively soon, and the reparatory changes prevail. Then the granulation tissue becomes less vascular and is soon transformed into scar tissue leading to consolidation of the vertebral bodies.

This type is found particularly in the lumbar region and usually remains limited to the bodies of one or two vertebrae, producing few symptoms, and little deformity. ⁽¹³⁾

II. The granulation Type.

This is the common form. Tuberculous granulations appear with no tendency to retrogression, rather to confluence of tubercles with caseation. In contrast to the dry form, the necrosis involves comparatively large pieces of bone which become sequestered. Caseation is followed by liquefaction of the necrotic area and the formation of tuberculous pus, walled off by a granulation tissue membrane. The contents of the cavity consist of tuberculous pus, cas-

eous debris, and fine particles of bone. In this type the tendency to progressive destruction is greater than in the former. The process of repair sets in later, and usually a considerable amount of necrotic material is found accumulated in tuberculous cavities before the process of repair has become definitely established. This is the typical form for the central type of vertebral tuberculosis.

As the reparative process finally becomes established, the granulation tissue becomes more avascular, and is transformed into scar tissue. Abscesses become walled off, their contents thicken, they become finally encrusted with lime salts and may calcify in the end.

III. The Embolic Type with infarction.

This is an embolic process, and while not uncommon in tuberculosis of certain joints, especially in the knee, it is the exception in Pott's disease. In this form the tuberculous granulation tissue around the site of the embolus develops so rapidly that a large area of bone is being shut off from circulation. It becomes necrotic and a circumscribed wedge of bone is then separated to form a definite sequestrum. The latter, enveloped by granulation tissue, becomes eroded on its surface, and, if small, may become completely absorbed. Larger sequestra become separated from their surroundings by a cover of granulation tissue. This type of tuberculosis is occasionally seen

in the cervical spine, and it often involves several vertebral bodies at the same time.

IV. Infiltrating or Progressive Type of Tuberculosis.

This type presents merely the secondary extension from a primary focus, which, producing an abscess under the anterior longitudinal ligament, goes on to erosion and infiltration of the anterior portion of the bodies of the adjacent vertebrae. From the granulation type it differs only by its mode of extension. The abscess accumulating under the anterior longitudinal ligament progresses downward, eroding and honeycombing on its way the anterior surface of the vertebrae.

Secondary Pathological Changes.

I. Deformity.

The characteristic deformity of tuberculosis of the vertebral bodies is antero-posterior kyphosis or gibbus formation, due to the forward collapse of one or more of the vertebral bodies. This is the natural result of the pathological changes following the tuberculous infection, which have brought about a central tuberculous infiltration, a progressive rarefaction of the all-important lamellae, a degeneration of the marrow, a failure of periosteal reaction, and a diminished blood supply. (4) These changes in a structure which must bear a constant and considerable superincumbent weight must almost inevitably result in a collapse of the so greatly weakened body.

The process of collapse is a mechanical one, and its various features have been worked out experimentally (14) by Bonnet and Menard.

The stage of collapse is usually a slow process, the evolution of months of an increasing subsidence, but it may develop with extraordinary rapidity.

The mechanism of the process varies in the different regions of the spinal column.

(a) In the cervical region the collapse is rarely, if ever, complete, owing to the fact that the pedicles and the transverse processes remain unaffected, and, acting as wedges, prevent the full inflexion of the upper segment on the lower. If the destructive process is such that two or more bodies are destroyed, the inflexion angle is correspondingly greater, but approximation of the opposing surfaces is still incomplete. While there is this imperfect inflexion of the opposing surfaces, the posterior arches involved in and adjacent to the disease are approximated one to another, and by doing so induce an appreciable degree of extension which may help to disguise the inflexion of the anterior collapse. It is evident that this mechanical distinction must influence the type and degree of cervical deformity, and in so far as inflexion is likely to be imperfect, the prognosis is also affected.

(b) In the dorsal spine the position is different. The collapse which follows the vertebral destruction is even-

tually complete, and, whatever may be the extent of the disease, the inflexion continues until the approximation of opposing surfaces is accomplished, the degree of the angle of inflexion increasing in proportion to the amount of destruction. This progression of inflexion, so different to the state of affairs found in the cervical region, depends upon the relation of the pedicles, which being attached to the posterior surfaces of the vertebral bodies, offer no real obstruction to the inflexion movement. The relation of the posterior arches shows an interesting change. The arch of the healthy vertebra which immediately overlies the disease is tilted upwards and forwards so that its spine becomes the real and most striking prominence of the kyphosis. The arch or arches of the affected vertebra are displaced backwards and slightly downwards.

(c) In the lower dorsal region a variation is encountered. When one or more bodies are destroyed, the inflexion surfaces are brought into apposition in such a way that the anterior surface of the vertebra immediately above the lesion comes to be in contact with the upper or articular surface of the vertebra immediately below (Menard's complete inflexion) - a peculiarity resulting from the natural resistance to inflexion of the ribs and the laminae, which in this situation are large and without any appreciable interlaminar space. This extreme flexion causes a subluxation of the lateral articulations, with the result that

the lowest lateral articular surface of the upper segment rests on the knife edge of the upper lateral articular surface of the segment below the gap. This is a most unstable condition and represents the so-called "pathological fracture dislocation" of spinal caries.⁽¹⁵⁾

(d) In the lumbar region collapse changes resemble those in the cervical region. Inflexion occurs, but it is to some extent disguised by a diminution of the normal lordosis and by a sinking of the posterior arch or arches so as to induce a slight amount of extension.

Relation of the Deformity to the Situation of the Lesion.

In the series of 100 cases investigated by Doub and Badgley⁽⁶⁾ it was found that there was collapse of the vertebrae in 54, and preservation of the vertebral body in 46. Twenty-four per cent had had symptoms for more than 5 years and among these the percentage of deformity was high. It was felt, therefore, that the percentage of collapse among the more recent cases was much lower than that pertaining to the whole series.

In the 46 cases without collapse, 36 were found to be epiphyseal in type and 2 anterior peripheral. The remaining 8 were central in origin. This demonstrates the relative infrequency of deformity resulting from the epiphyseal type and the relative frequency of deformity associated with the central type. The anterior peripheral form, as a rule, also shows preservation of the vertebral body form.

In studying the 54 cases in which collapse occurred, 50 were found to be central and 4 epiphyseal.

(8)

The Mechanics of Gibbus Deformity.

The degree of mobility in the antero-posterior direction which normally exists, from vertebra to vertebra, in the dorsal and lumbar spine has been thoroughly investigated by Albanese and others. To the natural range of forward flexion something more is added by the destruction of the vertebral bodies. This was done by the experimental removal of a wedge from the vertebral body. At the level of the 5th and 6th dorsal vertebrae this produced an inflection of 18 to 20 degrees. The same wedge removed at the cervical spine caused an inflection of 8 to 9 degrees only, and in the lumbar spine of 11 to 12 degrees. This explains the difference in deforming tendency and in degree of angulation in the various sections of the spine.

Natural Check.

In a number of cases a natural check is put up against forward inclination of the body by the formation of bony bridges spanned from vertebra to vertebra. As a rule these (16) natural provisions of defence prove insufficient. Coffield, in a study of 100 consecutive cases of tuberculous spondylitis, found 10 in which hypertrophic bone bridges were present during the active stage of the disease, usually in individuals of over 20 years of age. This is nature's attempt to produce spinal fixation.

Scoliosis in Pott's Disease.

Lateral curvature of the spine has long been known to occur in spinal tuberculosis.

The tuberculous nature of this lateral curvature usually reveals itself by the early rigidity of the spine due to muscle contracture.⁽¹⁷⁾ In later stages, however, much of the lateral deviation is determined by rapid infiltration and diffusion of the tuberculous process. In the dorsal spine lateral deviation is a most uncommon occurrence. In the lumbar spine, however, conditions are favourable both for anterior and lateral deviations, and here the lateral deviations are comparatively frequent, especially if the tuberculous focus in the body is asymmetrically situated. The scoliosis always points with its concavity to the side of the lesion.

It usually appears early in the course of the disease.

II. Abscess Formation.

With the collapse of the vertebral body a critical stage is reached in the progress of the disease. Hitherto the tuberculous disease has been limited within the confines of the bone, but, as the surrounding shell collapses, caseous debris and tuberculous granulation tissue are brought under pressure and actually forced from the intra-osseous focus into the perivertebral tissue - the development of the cold abscess has begun.⁽⁴⁾ The course which the abscess pursues varies within wide limits; it may

remain beneath the anterior common ligament of the vertebral column as a localised collection, or it may extend upwards and downwards, stripping the ligament from its attachment and denuding the underlying bone (cases II, III, IV, V, VII, XIII, XVI, XVIII, XX, XXI); it may gain entrance into the perineural tissues of the emerging nerves and be conducted thereby to a superficial area at some distance from the original site. The cellular tissue around a blood vessel may similarly guide its course, or it may pass within the compass of a muscle attached to the site in which the disease is occurring, the course of the abscess thereafter following the lines and direction of the muscle. It may extend so as to invade the vertebral canal and its contents, producing the most serious of the complications of Pott's disease - a pressure paraplegia. This will be considered later.

Frequency of Abscess Formation.

Abscess is the most common complication of Pott's disease and was found in 84 cases out of the 100 considered by Doub and Badgley. This figure is much higher than in other series. In Steindler's series of 200 cases, abscess was present in 30%. Vachelli found abscesses in 26.6% of his cases. The figures arrived at by autopsy are about 80%. This divergence of figures is accounted for by the fact that many of the tuberculous abscesses do not reach the surface or attain sufficient size to be of

clinical significance. These were not all discovered by X-ray examination, as some were present at the first clinical examination, and others developed during the period of observation; the largest number, however, were demonstrated by X-rays.

In analysing the frequency, according to the location of their origin, it was found that in the cervical spine both cases had abscess formation, in the dorsal spine, out of 44 cases, 39 were with abscess formation, or 88%. In the lumbar spine, 31 cases had abscess formation out of 45, or 69%. In the dorso-lumbar region, there were 12 out of 18 cases, or 67%.

Abscess formation may be the first X-ray evidence, and may be present before any bone change is noted. This is true especially in the epiphyseal type. In a number of cases the presence of abscess led to a careful search of the spine, and the disclosure of an early spinal lesion.

The presence of paravertebral abscess is almost pathognomonic of spinal tuberculosis, and its presence demands careful examination and continued observation over a long period.

Calcification of abscesses is a frequent accompaniment of healing.

Griffith and Summers, in their investigations into the frequency of bovine infection in tuberculosis, found in a small percentage of cases that tubercle bacilli were seen

under the microscope, yet the pus, when injected into a guinea-pig, did not produce tuberculosis, nor was a growth got on direct culture on the usual media. The bacilli in these cases were reasonably assumed to be dead, and the abscess sterile. (Case XV).

Abscesses, as already stated, are especially prone to leave their original site, to follow the forces of gravity, and finally to appear in remote regions of the body. The study of the migration of tuberculous abscesses from their original sites of development at the spine to their appearance at the surface a considerable distance from the original site, is a study of the muscle and fascial planes along which these abscesses extend. They always take the route of least resistance. The principal routes of migration of abscesses originating from caries of the vertebral column are the following:

(1) Abscess coming from the suboccipital region, from the 1st, 2nd and 3rd cervical bodies.

The abscess coming from the suboccipital region finds its way backward blocked by the great masses of the posterior muscles of the neck attached to the posterior tubercles of the transverse processes. Coming from the occiput and the posterior arc of the atlas, they may penetrate into the regions bounded by the posterior rectus muscles. As they tend to proceed more superficially, they encounter strong resistance in the tension of the posterior neck muscles,

which explains the unusual tenseness of the abscesses and the rigidity and spasm of the muscles involved.

(2) Abscess coming from the anterior portions of the first three cervical vertebrae, as well as those from the condyles of the occiput, may accumulate behind the anterior longitudinal ligament which is here more relaxed and allows the abscess to extend forward. In the loose areolar tissue underneath the prevertebral fascia, the abscess is now free to descend downward, or else it may gain the lateral aspect of the neck, entering the vascular compartment and appearing on the surface over the lateral triangle.

More often the abscess extends downward and forms a retropharyngeal abscess in the loose space between the pharynx and prevertebral fascia. Protruding against the pharynx the abscess may interfere with swallowing and embarrass breathing. Occasionally such an abscess may reach the anterior margin of the sternomastoid muscle, or extend backward and penetrate the vertebral bodies, accumulating between the posterior wall of the vertebral bodies and the meninges. This is a very grave complication.

(3) Abscesses coming from the lower cervical and upper Dorsal regions.

In the lower cervical region the abscess, as a rule, erodes the anterior longitudinal ligament and enters the posterior mediastinum. It may, however, appear in the supraclavicular fossa (case II). Those coming from the

vertebral bodies accumulate behind the posterior pharyngeal wall or penetrate into the spinal canal after erosion of the body. They may also be deflected downwards towards the axilla.

(4) The retromediastinal abscess, from the 2nd and 3rd dorsal vertebrae downward usually finds its way open to the posterior mediastinal space where it may increase considerably in size. From the 4th vertebra downward pus may freely aggregate until the diaphragm is reached at the level of the 12th dorsal vertebra. There the abscess, finding itself blocked, rises again and with increased pressure produces compression symptoms on the oesophagus or trachea, or may even perforate into the pleura and pericardium (case III).

These abscesses often extend laterally toward the transverse process or the costo-vertebral articulations. From here they reach the intervertebral or intercostal spaces and may appear as cold abscesses between the posterior portions of the ribs. In this situation differentiation from tuberculosis of the rib becomes difficult.

(5) The posterior extension of the prevertebral abscesses. In a number of cases the abscess situated underneath the anterior longitudinal ligament corrodes the surface of the vertebral body and finally penetrates through it into the spinal canal. In other instances this communication is established by the extension of the abscess around the bodies

and pedicles. The result is a pressure upon the spinal cord, and the attending compression symptoms constitute the gravest complication of vertebral tuberculosis.

(6) Subdiaphragmatic extension.

The narrow space between the internal crura of the diaphragm is a sufficiently effective barrier against penetration into the subdiaphragmatic space in all but a small minority of cases. After having found its way through the diaphragm the abscess progresses downward in the fascial sheath which forms the compartment for the psoas muscle. The most common route of extension is that between the iliopsoas muscle and its fascia. From here the abscess extends downward to the lesser trochanter following the run of the psoas muscle. Abscesses coming from the os ilei or from the 5th lumbar vertebra often penetrate behind the psoas muscle and then follow the ordinary course of the psoas abscess (cases VIII, XI, XVI). As they descend below Poupart's ligament they appear at the inner side of the thigh, often forming a bilocular abscess, with one portion above and one below Poupart's ligament.

The second subdiaphragmatic route is the suprafascial or subperitoneal. Here the abscess lies above the fascia of the iliopsoas muscle, and between it and the peritoneum. Further down it often penetrates the aponeurotic sheath of the muscle and enters the subperitoneal space. In

other instances the subperitoneal abscess may arise directly by perforation from the body of the lumbar vertebra through the anterior longitudinal ligament. These retroperitoneal abscesses follow the course of the external iliac vessels and gain the inner aspect of the thigh.

The retroperitoneal abscess is distinguished clinically from the subfascial psoas abscess in that the latter is situated in front of the femoral vessels and therefore the beat of the femoral artery cannot be made out, while the former leaves the artery laterally and the beat of the vessel can be palpated. Of the two types the retroperitoneal is much more serious because the opportunity for uncontrollable extension of the abscess throughout the pelvis is very great. Abscesses of this kind are often observed in tuberculosis of the 5th lumbar and of the os ilei as well as in sacroiliac tuberculosis. They are extremely difficult to drain and, once becoming infected, they give rise to severe sepsis to which the patient very often succumbs. The retroperitoneal abscess may compress the ureter or the bladder, or perforate into the latter. It may also surround the intrapelvic organs, reach the ischio-rectal space and develop into an ischiorectal abscess. It may also extend laterally towards the greater sciatic notch and follow the run of the great sciatic nerve in the posterior compartment of the thigh.

(7) The lumbar abscess.

Abscess from the lumbar region or the region of the sacroiliac articulation may extend straight laterally and find an outlet over Petit's triangle, which is bounded anteriorly by the external oblique muscle, posteriorly by the latissimus dorsi, and below by the bony rim of the pelvis.

(8) Abscesses coming from the vertebral arches and the spinous processes.

These abscesses may penetrate into the muscular layers and appear close to the midline in the back (case I). In the cervical segments the course of the abscesses has already been described. In the dorsal segment the abscesses appear as prevertebral abscesses at the lateral border of the erector spinae mass. In the lumbar region a paravertebral abscess is rare. In the majority of cases such abscesses follow the line of the psoas muscle into the abdominal cavity, or work their way round into Petit's triangle.

(4)
III. Compression of the Cord.

Interference with the spinal cord is one of the gravest complications of Pott's disease, and the subject early attracted the serious attention of many observers. There is still debate as to the mechanism by which the cord becomes subjected to pressure. The older views, that the curve of the gibbus was the responsible feature, or that

it resulted from impingement on the cord of the sharp corner of a displaced vertebra (the *vive arrête* of the French surgeons) are of historical interest only. The extrusion of a sequestrum is a possible but extremely rare possibility.

The views at present credited, and for that matter proved, are that it proceeds either from an intraspinal abscess, ⁽²⁰⁾ or from a pachymeningitis externa with the development of tuberculous granulation tissue. ⁽²¹⁾ In certain instances both possibilities may occur. As the vertebra collapses caseous debris collects beneath or anterior to the common posterior vertebral ligament. This is a structure of considerable strength with lateral attachments to the deep surfaces of the pedicles, and therefore it limits any caseous collection laterally, while permitting its extension upwards or downwards to considerable distances. If it should happen that this ligament is perforated by the disease along one or other of the minor blood vessels which traverse it, the tuberculous infection collects in the epidural space as an epidural abscess. In this event its extension is virtually unbounded; it often passes completely around the spinal cord, while it is apparent that it can pass upwards or downwards as far as the vertebral canal extends. Actually its course is generally limited by a barrier of epidural fat.

Though such an abscess remains in close contact with

the outer surface of the meninges over a long period of time, there may be no invasion of the latter. In a certain proportion of cases a true pachymeningitis may develop, involving all the meninges and even the underlying cord.

The direct involvement of the cord is closely related to the vascular arrangements. The anterior spinal artery runs as a single trunk along the front of the cord underneath the thickened vertical fibrous band of the pia mater, the linea splendens. From this vessel a series of segmental branches (the anterior median arteries) enter the anterior median fissure to supply the corresponding right and left halves of the grey matter of the cord and the tracts of the anterior fasciculi.

When the tuberculous disease has perforated the membrane its further progress into the spinal cord is along these vessels, so that pressure or destructive effects are early extended upon the fibres of the pyramidal tract. This is one of the reasons why the paralysis of Pott's disease is in the majority of cases of the spastic motor type. In extensive disease the influence of the vascular distribution leads to invasion of the grey matter of the anterior horns, with resulting flaccid paralysis in the related muscular areas.

Degenerative changes may appear in a cord which shows no actual tuberculous invasion. They may arise as the

result of mechanical pressure, though this is unusual, as there is abundance of room within the vertebral canal; more frequently they are the sequelae of vascular obstruction and a lymphatic oedema, a change which, if long-standing and severe, may result in permanent degenerative features with destruction of nerve cells, neuroglysis, ascending and descending tract degeneration, and even lacunar formation. Pressure effects may be exerted upon nerve roots as well as upon the spinal cord - a point which is obviously of great significance in certain aspects of the clinical history.

(22)

In a recent monograph of Madame Sorrel-Dejerine, the author reports the incidence of the complication in 500 cases as 8%, grouped as follows: 32 cases in dorsal disease, 4 in low cervical disease, 5 in dorso-lumbar disease, 1 in lumbar disease. Various reasons have been put forward to explain the high incidence of the disease in mid-dorsal and upper dorsal cases. (1) It is suggested that one explanation lies in the fact that in the upper dorsal spine the vertebral canal is relatively narrow in proportion to the spinal cord. (2) A second reason put forward is that when a high dorsal kyphosis occurs and an abscess develops, the abscess cannot escape with the facility which it does in cervical and lumbar disease, because in the latter instances there are various muscular attachments which are responsible for leading the tuberculous debris into an

extraspinal position.

Multiple or Skipped Infection.

By that is meant two areas of tuberculous infection with apparently normal vertebrae between these areas. (Case XVI). This is said to be rather rare and Peabody⁽²³⁾ reports its presence in 4.1% of a series of cases. Among the recent cases, in his series, which had complete data, he found 8% as the incidence, and he believes that the real incidence may be higher than the latter figure. He also found practically all the secondary lesions lower in the spine than the primary lesion and concluded that they were probably produced by contact with the gravitating pus.⁽⁶⁾

Doub and Badgley in their series of 100 cases found 10 cases of multiple infection, in 7 of which the secondary lesion was above the primary and in 3 it was below. (Case XVI belongs to the first class). In 7 cases the lesions were close enough to each other to suggest that infection may have resulted from direct extension by gravitating pus. In three of these, however, the lesions were widely enough separated to suggest an entirely new lesion. It is possible, therefore, that the multiple type of infection may have its origin either by contact with pus from the original lesion or by a new haematogenous infection.

Reparative Changes in Spinal Tuberculosis.

Nature aims at bony fusion of the vertebral body, thereby limiting the tuberculous process. This fusion is

either total or partial, and extends not only to the bodies themselves but also often includes the transverse processes and arches. In the majority of cases there appears also fusion of the posterior portions of the spine, and ankylosis of the intervertebral articulations as well as fusion between the laminae, the transverse and sometimes even the spinous processes. Bony fusion is the usual event in children, but in adults the reparative process usually terminates with fibrous union. The natural fusion of the posterior portions of the vertebra is to be regarded as responsive osteogenetic reaction to the stimulus of the tuberculous foci within the body.

The formation of the gibbus must be viewed as a phenomenon of repair. In children the repair of the vertebrae appears on X-ray as complete bony fusion of one or two of the involved segments. In adults healing occurs by granulation tissue, which is finally transformed into healthy scar and connective tissue, consolidating the spine by fibrous adhesions.

The deforming process finds a natural check in the formation of a bony block formed by the collapsed vertebral bodies.

In the reparative process in the tuberculous abscess small ones become completely absorbed, larger ones are walled off by connective tissue and gradually become sterile. They are then transformed either into a mucous fluid or

become calcified. About 30% became clinically manifest as superficial cold abscesses.

ETIOLOGY.

Frequency of Tuberculosis of the Spine.

(24)

Wullstein found among 100,000 cases of a large surgical clinic, 0.365% of spinal tuberculosis, and relative (25) to the number of orthopaedic patients Wallace found the frequency ratio to be 1.5% among 148,000 cases. Steindler's figures (8) are 2% to 3% of all orthopaedic cases.

The frequency ratio to autopsy findings in a combined table which includes 47,000 post mortems is 1.48% The ratio of Pott's disease to surgical tuberculosis in general is given variously from 30% to 50%. Steindler's series shows a ratio of 30%.

It is probable that the frequency of tuberculosis of the spine (1.5%) among the hospital population is considerably higher than that of civil life.

Proportional Frequency of Human and Bovine Infection.

This aspect of infection has been investigated by (56) Griffith and Summers, the material used being obtained from patients suffering from bone and joint tuberculosis in Millport Orthopaedic Hospital. The patients admitted to this institution are drawn from counties in the middle west and south of Scotland.

Out of 81 cases investigated, 31 had spinal caries. The percentage of bovine infection in the spinal cases was 25.8, which is practically the same as that for spinal cases

in the much larger English series - viz. 25.5.

Over the whole of the Millport series, it was found that two-thirds of the children under five and more than half of those under ten years of age were infected with bovine tubercle bacilli.

The importance of age in the Frequency of Pott's Disease.

Tuberculous spondylitis is largely a disease of the growing bone, but the disease is not at all uncommon in later life.

(24)

In the combined tables of Wullstein, Vulpius, Drachmann and Mohr, 85% of the patients were younger than 20 years and 14.7% older. The period from 4 to 10 years shows the highest frequency, 65.8% of all cases.

(6)

In Doub and Badgley's series of 100 cases the average age was much higher, 29 years. Twelve patients were under 10 years of age and 59 were 30 or under. These cases were not all actively diseased, being longstanding and really admitted for other complaints, but giving permission to the authors to study the old lesion: hence the figures are higher than average.

Frequency and Sex.

There is no great difference in the distribution among sexes. In both the tuberculosis prevails in the dorsal region; in the male the figures for the dorsal spine are somewhat lower, and those for the lumbo-dorsal area somewhat

higher than in the female.

Frequency of the Site in Vertebral Tuberculosis,

In John Fraser's series of 100 cases from the records of the Sick Children's Hospital, Edinburgh, the site distribution is as follows: cervical spine, 4 cases; dorsal, 68 cases; and lumbar, 28 cases. ⁽⁴⁾

The maximum occurrence was in a segment embracing the 10th, 11th and 12th dorsal and 1st lumbar vertebrae, in which area there were 51 cases. In Doub and Badgley's series of 100 cases ⁽⁶⁾ the incidence was as follows: cervical spine, 2 cases; dorsal spine, 44 cases; dorso-lumbar spine, 18 cases; and lumbar spine, 45 cases. This shows a relatively high number of lumbar cases.

⁽²⁶⁾ Clinical figures show 12% for the cervical, 60% for the dorsal, and 28% for the lumbar spines. Autopsies show 26% in the cervical, 53% in the dorsal, and 19% in the lumbar spine.

⁽⁸⁾ Steindler's figures are 6.9% for the cervical, 3% in the cervico-dorsal, 42% in the dorsal, 15% in the dorso-lumbar, 30% in the lumbar, and 2.6% in the sacral sections.

Both clinical and autopsy observations agree on a preponderance of involvement of the dorsal spine; next is the lumbar and last in frequency is the cervical spine.

Influence of Heredity.

That heredity is of considerable importance in the

development of spinal tuberculosis seems certain. Its influence can be traced in approximately 20% of cases (Steindler).

Influence of Trauma.

In attempting to assess the influence of trauma as a factor in spinal tuberculosis, it must be assumed that such a focus pre-exists, but has remained dormant and is merely becoming manifest after the trauma. In the words of Pott, ⁽¹⁾ "I will not assert that external mischief is always and totally out of the question, but I will venture to affirm what is equal, as far as regards the true nature of the case, which is, that although accident and violence may in some few instances be allowed to have contributed to its more immediate appearance, yet the part in which it shows itself must have been previously in a morbid state, and thereby predisposed for the production of it." If only such incidences are included which by their manner of occurrence or by their frequency appear to have a causal connection with the disease, it is likely that figures from 7 to 10% would come nearest to the truth as the proportion of cases in which trauma plays a part in causation. Since the first Accident Congress at Leipzig in 1922 opinion in Germany has been greatly strengthened in favour of the belief that a causal relation between injury and tubercle is extra-
⁽⁵⁵⁾
ordinarily rare.

Association with tuberculosis in other parts.

The usual conception of Pott's disease is that it is part of a generalised tuberculosis which may or may not be active at the time. It has also been known that the pulmonary lesion is the most commonly manifested concomitant lesion and Steindler found that 17% of his spinal cases showed associated phthisis.

(6)

In Doub and Badgley's series of 100 cases, concomitant tuberculosis in other parts of the body was found in 54 instances. They found 24 who had a pulmonary lesion associated with the spinal lesion. The next most common area to be affected was the genito-urinary tract, in which it was present in 8 cases. Tuberculous abscesses not associated with the spine were present in 7 cases. Six cases had evidence of tuberculous joints outside the spine. (Cases XIV, XV, XVIII). Tuberculous glands were found in 3 cases; 3 died of tuberculous meningitis (case VII), and 2 had tuberculous osteomyelitis of other bones.

Average Duration of Symptoms at the different age periods.

<u>Age Period</u>	<u>Average Duration of Symptoms.</u>	
0 - 10	10 months	
11 - 20	18 $\frac{1}{2}$ months	
21 - 30	48 $\frac{1}{2}$ months	
31 - 40	52 months	
41 - 50	6 years	
51 - 60	12 $\frac{1}{2}$ years	
61 - 70	15 years	
		Doub and Badgley's series of 100 cases (6)

This table shows that the average duration of symptoms was

much lower during the 1st decade, and gradually but steadily rose with each succeeding decade of life. This is partly accounted for by old healed cases, and by cases which had been under treatment for long periods.

The average duration of symptoms in all cases was $6\frac{1}{2}$ years. The duration of symptoms was one year or less in 48% of the cases, and from 1 - 5 years in 28%. It would appear that approximately one half of the cases consulted them during the early stages of the disease.

Symptoms.

I. General Signs.

The local clinical features of Pott's disease are ushered in by an introductory period, which corresponds pathologically with an early central lesion.

The signs of this period are those common to any active tuberculous focus - weight falls and nutrition fails, there is backache and tiredness on exertion, and occasional evening pyrexia. Anaemia is present, and there may be restlessness during sleep. In a child there may be a slight degree of infantilism and the abnormal growth of fine downy hair on the back and elsewhere.

II. Local Signs.

(1) The clinical picture of the established disease may be said to date from the onset of pain, local or referred, or in many cases a combination of both. Local pain may

be spontaneous, or it may be elicited by movements or by manipulation. Whatever its type, the irritation of or pressure upon nerve endings is the real etiological factor.

Local pain is of a dull, aching character, increased by movement, jarring or fatigue, and is relieved by lying down.

If the patient is a child, it is noticed that he ceases to play with his companions, and inclines to sit or lie about, usually assuming some peculiar attitude which tends to take the weight off the affected segment of the spine. If he is going about, the pain increases as the day goes on, but may pass off during the night.

Local pain is complained of very frequently in adults, as one of the earliest signs of spinal tuberculosis. In children this type of pain is manifested by night cries in many cases, due to a sudden relaxation during sleep, of the reflex rigidity of the dorsal muscles, which guards the spine against painful intervertebral movements. Night cries are met with in those portions of the spine in which the inflexion is incomplete, and is therefore indicative of cervical and upper dorsal disease.

Referred pain. The significance of referred pain should be appreciated. Its genesis is the pressure which the collapsing vertebral body is beginning to exert upon the related nerve roots. The distribution of the pain

varies according to the anatomical relations of the nerves affected.

In the cervical region it may take the form of ear-ache, or pain in the occipital region, chest, shoulders or arms.

In dorsal disease pain is referred to the sternum or epigastrium or takes the form of an intercostal neuralgia. It is often mistaken for "stomach ache". In dorso-lumbar cases there is girdle pain or pain in the iliac region.

In lumbar disease there is pain referred to the hips and legs.

Tenderness may be elicited on pressing over the spinous or transverse processes of the diseased vertebrae, or on making pressure in the long axis of the spine. The absence of this sign does not exclude the possibility of spinal caries, as it is rather inconstant, especially in children. Pain is often complained of after sneezing, coughing or forced expiration, and such acts are carefully avoided.

III. Rigidity.

The pain produced by movement of the diseased portion of the spine causes reflex contraction of the muscles passing over it, and the affected segment of the spine is thus rendered rigid. This rigidity of the diseased portion of the column with "boarding" of the muscles of the back, is one of the earliest and most valuable diagnostic signs



of Pott's disease. It is found that there is complete absence of movement between the vertebrae actually diseased.

In the endeavour to immobilise the spine by active and voluntary muscle control against any movement, the patient assumes a peculiar and characteristic attitude, varying with the segment of the spine affected.

In the upper cervical region the neck is held rigid, and to look to the side the patient turns his whole body round. As the disease advances the head may be bent to one side as in wry-neck, or it may be retracted and the chin protruded. To take the weight of the head off the diseased vertebrae the patient often supports the chin in the hands. In high dorsal disease he uses his hands to brace himself against nearby objects, relieving the spine of the weight of the head and of the upper portion of the trunk.

In dorsal disease, on being asked to pick up an object from the floor, the patient reaches it by bending his knees and hips, while he keeps his back rigid. He refuses to make any movement that involves jolting of the spine, such, for example, as jumping from a chair to the ground. Children often attempt to take the weight off the diseased vertebrae by placing the palms of the hands on the edge of a chair, so that the weight is borne by the arms.

In dorso-lumbar caries, children while standing often

assume a characteristic attitude - the hips and knees are slightly flexed, and the hands grasp the thighs just above the knees. In this way the weight is partly taken off the affected vertebrae and borne by the arms. As the patient straightens up from a crouched position he carefully climbs up with his hands placed upon the thighs. Rigidity is a much more constant symptom of Pott's disease than pain, local or referred, and is found in 73% of cases.

A peculiarity of the gait is often created by a psoas abscess, resulting in flexion contracture of the hip joint. In this case the body is thrown forward with the affected leg flexed at knee and hip, and the patient walks on the toes.

IV. Deformity.

The factors which affect the form of the spine are the destruction of the vertebrae and the intervertebral discs, the muscular rigidity which results from attempts to anticipate movements and jars, and the compensating curves due to the necessity for holding the head erect.

Deformity is a frequent, though by no means a universal symptom. In children it is often early in developing; in adults it usually occurs later.

Antero-posterior deformity usually develops slowly and insidiously over a period of weeks or months. In exceptional cases it may develop very rapidly, following a sudden collapse of the vertebrae. Deformity is usually

distinct and angular in shape, unlike the rounded deformity seen in rickets. The gibbus of Pott's disease cannot be made to flatten out as the patient, lying prone, has his legs and pelvis lifted off the table, whereas in a rachitic curve under these conditions it flattens out and disappears. Lateral deviation is not uncommon in Pott's disease, most frequently found in the lower dorsal and lumbar spine, and is due to an asymmetrical distribution of the lesion within the body of the vertebra.

The commonest curve is an angular one, the spinous process of the highest vertebra diseased making a marked prominence; but in the diffuse form of the disease met with in adults there is a gradual kyphotic curvature involving several vertebrae. Occasionally in the dorsal region the deformity presents itself as a lessening of the normal curve, giving a rigid flattening, the so-called "poker-back"; in lumbar caries also there may be a flattening, from loss of the normal concavity. In disease of the cervico-dorsal and upper dorsal regions there is sometimes very great deformity (case V). The ribs take a sharp downward slant, the thorax appears flattened anteriorly, and the sternum protrudes more at its lower end. The result of the deformation is that the antero-posterior diameter appears shorter, the thorax is flattened from side to side, and the vertical diameter is lengthened. If, on the other hand, the gibbus occupies the lower dorsal or

lumbar spine, the opposite deformity results. In advanced cases the ribs become crowded together and the sternum projects forwards. The antero-posterior diameter of the thorax is thus increased, while its vertical diameter is diminished. These changes, together with the telescoping of the vertebral bodies, lead to the deformity characteristic of the tuberculous hunch-back. The alterations in the shape of the chest may lead to functional disturbances of the heart and lungs. The deformed spine usually displaces the oesophagus or the vena cava. In extreme cases the aorta may develop kinks and torsions which may form serious obstacles to the circulation, especially if combined with gross displacement of the heart itself. The apex of the heart has been found displaced as low as the bifurcation of the aorta, and the level of the diaphragm in severe cases is considerably lowered and with it there is also displacement of the organs of the abdominal cavity.

(8)

Steindler finds antero-posterior deformity present in 65% of his cases, moderate in 32%, marked in 24% and extreme in 9% of all cases.

Pott's disease in the lumbo-sacral region usually affects adults, and, on account of the breadth of the vertebral bodies, and the limited range of movement in this segment of the spine, it is seldom accompanied by marked deformity.

When the disease begins in childhood it may induce

a permanent deformity of the pelvis, the conjugate diameter at the brim being increased, while the transverse diameter at the outlet is diminished - kyphotic pelvis.

Another deformity sometimes met with is "bayonet deformity", where there has been a lateral deviation at the site of the lesion, giving an appearance resembling that of the old type of bayonet (case XVI).

V. Signs and Symptoms of Abscess Formation.

Abscess formation may be the first X-ray evidence of Pott's disease and may be present before any bone change is noted. This is true especially in the epiphyseal type of spinal caries. In a number of cases the presence of abscess led to a careful search of the spine and the disclosure of an early lesion. (6)

In tuberculosis of the spinous and transverse processes cold abscesses are commonly the only local clinical manifestations of the disease, other than the X-ray appearances. (Case I).

Wandering abscesses, that is, those that leave their original sites, and, wandering within fascial planes, finally reach the surface at remote points, are present in about 30% of cases. (8) In the cervical region an abscess may form between the vertebrae and the wall of the pharynx - retropharyngeal abscess - the pus accumulating between the diseased bones and the prevertebral layer of the cervical fascia. The abscess may project towards the pharynx

as a soft fluctuating swelling, and may cause difficulty in swallowing and breathing, and snoring during sleep; if it bursts internally it may cause suffocation. The abscess may bulge towards one or both sides of the neck, and come to the surface behind the posterior border of the sterno-mastoid muscle (case II). In some cases it comes to the surface in the suboccipital region. In other cases it may pass into the axilla, or downwards into the mediastinum.

In the cervico-dorsal region an abscess may come to the surface in the lower part of the posterior triangle, or may spread into the posterior mediastinum or into the axilla. Sometimes the pus burrows behind the oesophagus and trachea and may find its way into the pleural cavity. The cord is not often pressed upon; when it is, the cervical sympathetic is implicated.

In the dorsal region a mediastinal abscess is formed and is commonly recognisable only radiographically (case III). Affection of the pleura, however, may occur, or of the lung, so that the first symptoms noticed may be pulmonary, e.g. empyema.

The pus may pass directly backwards along the posterior branches of the intercostal nerves and vessels, and come to the surface behind the transverse processes, or it may travel forward between the pleura and the ribs, and, passing along the course of the lateral cutaneous branches

of the intercostals, come to the surface opposite the middle of the rib. In the latter case, the abscess is liable to be mistaken for one associated with tuberculous disease of the rib, particularly as the rib is usually
(27)
found to be bare.

When the disease is on the anterior surface of the bodies of the lower dorsal vertebrae, the pus may spread down through the pillars of the diaphragm and reach the sheath of the psoas muscle (cases VIII, XI, XVI). In the dorso-lumbar region an abscess usually occupies the sheath of the psoas muscle, in which it spreads down towards the iliac fossa, and into the thigh, passing beneath Poupart's ligament, posterior and external to the femoral vessels. The communication between the pelvis and the thigh is often very narrow, so that the abscess cavity has to some extent the shape of an hour-glass. The pus may reach the surface in the region of the saphenous opening, or may spread further down the thigh under cover of the deep fascia. In some cases it is liable to be mistaken for a femoral hernia, as the swelling becomes smaller when the patient lies down, and has an impulse on coughing.

The earliest sign of involvement of the psoas muscle is loss of the movement of extension of the hip joint. This movement may be tested with the subject prone, or limitation of hyperextension may be shown by raising the pelvis of the supine patient, when the normal dropping of the

(28)

thigh from gravity is not seen on the diseased side.

Its further progress may cause it to appear in the popliteal space or even on the inner side of the ankle. In the lumbar region the adductor area may be reached by an abscess that passes from the psoas into the pelvis and thence through the obturator foramen. The buttock and back of the thigh may be attained by abscesses leaving the pelvis through the great sacro-sciatic notch - sub-gluteal abscess. It may pass through the obturator foramen and reach the perineum as an ischio-rectal abscess, while the infection may spread to the sacro-iliac joint or the hip. Sometimes in lumbar disease the pus travels along the posterior branches of the lumbar vessels and nerves to the outer border of the erector spinae and comes to the surface between the edges of the latissimus dorsi and the external oblique muscles, in the triangle of Petit.

In the lumbo-sacral region single or double iliac abscess (case XIX) may form without the patient showing any characteristic signs of spinal disease.

V. Compression Paraplegia. (Cases I, II, XIII, XIV, XVII, XXII)

Pressure on the spinal cord may arise from one or more of three causes - the pressure of an intravertebral abscess, the more gradual but more extensive process of a tuberculous meningitis, and the pressure which results from an
(4)
intracordal oedema. On occasion it may be the first sign

of the spinal lesion.

In relation to the manner of production of spinal cord pressure, there are certain clinical characteristics which may be summarised as follows:

- (1) That the paraplegia consequent upon an intra-vertebral abscess is often sudden in its onset and favourable in its prognosis.
- (2) That when meningitis is the source, the onset is gradual, the paralysis extends to a higher level than the bone lesion would indicate, while the prognosis is less hopeful. (Case II).
- (3) That an oedema paraplegia is often a sudden complication, the paralysis being incomplete, while the signs may vanish with comparative rapidity. (Case XIII).

(1)

In his "Further Remarks" Pott gives an excellent picture of the development of a pressure paraplegia. He says: "The account most frequently given is, that for some time previous to the incapacity, the child had been observed to be languid, listless, and very soon tired: that he was unwilling to move much or briskly: that he had been observed frequently to trip and stumble, although no impediment lay in his way: that, when he moved hastily or unguardedly, his legs would cross each other involuntarily, by which he was often and suddenly thrown down: that if he endeavoured to stand still, and upright, unsupported by another person, his knees would totter and bend under him: that he could not with any degree of pre-

cision or certainty, steadily direct either of his feet to any particular point, but that in attempting so to do, they would be suddenly and involuntarily brought across each other: that soon after this he complained of frequent pains and twitchings in his thighs, particularly when in bed, and of an uneasy sensation at the pit of his stomach: that when he sat on a chair, or a stool, his legs were almost always found across each other, and drawn up under the seat: and that in a little time after these particulars had been observed, he totally lost the power of walking."

In caries of the lower cervical vertebrae one finds occasionally paralysis of the upper extremity as well as of the lower, and of the musculature of the thorax and abdomen.

There is at first weakness or paresis of the muscles supplied from the part of the cord below the seat of pressure. The knee jerks and ankle jerks are exaggerated and an extensor plantar response is present. Later there is paralysis of the spastic type, varying in extent and sometimes amounting to complete paraplegia, and this may come on gradually or quite suddenly. There is wasting of the muscles from disuse, and later a tendency to contracture and the development of deformities as a result of sclerosis or descending degeneration of the cord. The contractures set in at a time when the patient is already bedfast. Then appear

the flexion, adduction and inward rotation contractures of the hips, and the flexion contractures of knees and ankles. The flexed knees are pressed tightly against each other, and the limbs are often crossed.

As the degeneration of the spinal cord proceeds, the symptoms change from the spastic to the flaccid type (case XVII).

In addition to the motor disturbances, there are sensory derangements from pressure either on the cord or upon the nerve roots, with girdle pains, anaesthesias, both superficial and deep, and paraesthesias, and occasional weakness and wasting of the muscles supplied by the nerves. If the lesion lies between the fifth and eleventh dorsal segments the sympathetic fibres may be involved, with development of oculo-pupillary symptoms. Disturbances of the organic reflexes of the bladder and rectum occur in some 50% of cases, and they vary from the slighter disturbance of urgent micturition and constipation to the secondary automatism of the reflex acts, with the danger of ascending genito-urinary infection. Pott described this condition as "most miserable to endure, most pitiable to see."

Trophic and vaso-motor changes may occur also - herpes zoster, coldness, perspiration and cyanosis of the limbs are the most common.

If the spinal cord becomes actively invaded by disease, a general automatism is evidenced below the level

of the lesion, and analgesia is present.

In Steindler's series, there were, among 220 cases examined, 44 cases, or 20% paralysis, if cases showing only exaggerated reflexes were excepted. Of these 44, 13 were complete and 31 partial.

DIAGNOSIS.

From the point of view of a general practitioner, Pott's disease is a very uncommon condition. Met with only very occasionally among the comparatively trivial everyday complaints, it is one of the last things of which one thinks.

In a child the development of a gibbus is usually the first thing which brings it to mind, while in an adult it is usually only **diagnosed** on X-ray examination of a case which has not responded to other treatment.

Routine Clinical Examination.

A. History.

(1) Family history should first be investigated, particularly any family tendency to tuberculosis. Owing to the frequency of bovine infection in children, one should always enquire into the type of feeding in infancy - whether breast or cow's milk, duration of breast feeding, and the class of cow's milk used. The state of health of parents, brothers and sisters should be enquired into, also cause of death if there are any gaps in the original number.

(2) The previous health of the patient should next be noted - any childhood troubles, particularly nutritional disturbances and retarded development. Any infectious children's troubles should be noted, also susceptibility to colds and affections of the nasopharynx.

History of gastro-intestinal troubles should be enquired for, as a possible source of the tuberculous infection.

(3) The early history of the present illness should be closely investigated; how long since the patient was last in good health; when loss of appetite, listlessness, disinclination to play, etc. were first noticed.

Any loss of weight should be noted, also any history from patient or relatives of development of abnormal posture and gait, rigidity of the body or difficulty in walking.

Ask for any onset of pain, local or referred.

(B) Physical Examination. In no disease is the routine of a detailed physical examination more important than it is in Pott's disease. It includes -

- (1) Observation of general appearance and nutrition.
- (2) Examination of body attitude and gait.
- (3) Inspection of the spine.
- (4) The taking of some form of permanent record of the spinal outline.
- (5) Examination of spinal movements, active and passive.
- (6) Examination of the nervous system - reflexes, superficial and deep, sensation and motor function.
- (7) Examination of certain areas of the body for the presence of cold abscesses.
- (8) Observation of compensatory changes as they occur in the cranium, thorax or pelvis.
- (9) Examination of the rest of the body, particularly the lungs, heart and great vessels, by the usual clinical methods.

- (10) The taking of a series of X-ray photographs, antero-posterior and lateral, of the segment of spine containing the affected vertebra or vertebrae.

Important practical details in the taking of radiograms in spinal lesions are (1) that the tube must be focussed directly over the affected disc, and (2) that a low penetration (45-55 Kv) should be used in children in order to obtain clear details of bone structure.

One proceeds with the physical examination of the patient by having him first fully undress and then examining him in the standing position.

His general physical condition is noted - with any tendency to emaciation, anaemia, etc.

Abnormal attitudes of posture, gait and carriage become apparent. The patient is then told to go through the ordinary motions of walking, running, stooping, squatting, sitting and rising. The patient's manner of turning, of bending, of rising from the floor, of picking up objects, of holding his head, and using his hands in support of his body, etc. may become significant.

The site of a lesion may often be brought to light by running the finger down the spinous processes and estimating their spacing. Crowding of the spines or undue space between two of them is very suggestive. Kofman⁽²⁹⁾ describes an early sign of spinal caries in the pregibbus stage. In examining a healthy individual with his back facing the light and his arms hanging at his sides, the normal groove

of the spinal column is seen between two muscular bands along its whole course. If the spine is affected, it is noticed that these muscular bands diverge more or less, forming a rhomboid or "delle", which is an oval-shaped depression. Palpation of the muscles encircling the "delle" shows them to be soft and somewhat doughy. They do not contract. This is more evident with the patient in a prone position. This "delle" is the location of the future gibbus. He claims that this sign has enabled him to diagnose spondylitis two or three years in advance of other clinical evidence. This test is not in itself pathognomonic of a tuberculous lesion of the spine, but indicates that this portion of the spinal column does not participate in the motions of the entire spine. The specific sign is the softening of the long muscles of the back, owing to loss of tone. He observes that, in the case of a favourable turn in the process, the muscles regain their contractility and firmness.

(4)

John Fraser describes a test which sometimes enables us to elicit the site of the disease. A cold or hot sponge is passed slowly along the spine so as to cover the area of the points of exit of the posterior primary division of the nerve roots. As this is done it may be that in a certain zone undue sensitiveness is complained of, and we accept the sign as indicating that the nerve root or roots corresponding to the distribution of the

hyperalgesic area are themselves irritated by an oedema, the result of vertebral disease.

The demonstration of a direct objective pain may be difficult. Pressure upon the spinous processes is rarely effective; a rotatory movement must be instituted, and pressure on the transverse processes is therefore employed, or, if the lesion is in the dorsal area, rotation is induced by exerting pressure on the ribs at some distance from the middle line.

Rigidity of the spine is tested by palpation with the patient in the prone position. The feet and legs are lifted to see if the spine will follow the movement of the hips in a normal manner or whether it will maintain itself in a state of rigidity. The spine is examined for local tenderness on pressure, and also by distant pressure with the hand on the head. The mobility of the cervical, dorsal and lumbar spines is tested.

Abscesses are looked for by palpation and percussion at both sides of the spine, at the cervical triangle, in the axilla, at the posterior intercostal spaces, in Petit's triangle, as well as in the region of the sacrum, perineum and gluteal muscles.

The body is examined for glandular enlargement at neck, axilla, groin and elbow.

The lungs are thoroughly examined by inspection, percussion and auscultation.

The patient is then turned on his back and the knee jerks, ankle jerks and plantar reflexes are tested. Ankle, hip and knee movements are tested, followed by testing of the cremaster and umbilical reflexes, and the reflexes of the upper extremity as well as the pupillary reflexes.

The outlines of the lungs and heart and the position of the diaphragm are then determined.

Abscesses are looked for in the lateral triangles of the neck, the supraclavicular fossa, the axilla, the groin, the iliac fossa, below Poupart's ligament, at both sides of the thigh, in the perineal and ischio-rectal regions.

The movements of the hip joint are tested for the presence of psoas abscess (as previously described).

Any evidence of muscular relaxation or rigidity is important as showing or excluding commencing paralysis.

Cutaneous and deep sensibility tests follow. A general examination of the body should be made, including heart, lungs, gastro-intestinal tract, upper air passages, and a thorough examination of the blood and urine.

III. The tuberculin reaction is of diagnostic value under the age of five as it strongly indicates the tuberculous nature of the surgical condition under investigation, if found to be positive.

Otherwise it is only of value in that a triple negative reaction excludes tuberculosis as the source of

the lesion in question.

IV. X-ray in the Diagnosis of Spinal Tuberculosis. It is very necessary in most cases that both antero-posterior and lateral views should be taken. If the spine is angled, the disease is found at the angle. Help is got by looking at the spacing of the vertebrae. Doub and (30) Badgley have pointed out the significance of merely a slight narrowing of the intervertebral disc as an early sign of Pott's disease. In some cases abscess formation is the first sign but in nearly all of these cases there was narrowing of the disc at that time or shortly afterwards. In their series of 100 cases they found complete disappearance of the disc in 83 cases and definite narrowing of the disc in 17.

Gross destruction of bone is easily determined. More difficult is the interpretation of slight changes in contour, and of haziness and blurring. New bone formation is some indication of the process of repair, though it may occur concurrently with destructive changes.

The X-ray picture is also of great value for the recognition of tuberculous abscesses which must be distinguished from other normal or pathological shadows.

In the first or second year of life the thymus shadow may be misleading.

The aorta and heart shadow should not give rise to error. The enlargement of the normal psoas shadow later-

ally is suspicious of psoas abscess.

Other pathological shadows may give rise to error, such as spinal tumours, tumours of the lung, enlarged hilus glands, etc.

Aortic aneurysm may lead to confusion.

Having recognised the shadow as an abscess, it may be difficult to decide whether it is spinal or extraspinal. Spinal abscesses are usually spindle or pear-shaped.

V. Lipiodol in the Diagnosis of the Site of the Lesion.

In Millport lipiodol has been used since 1928 to track sinuses. Three to ten cc. are injected into the sinus with a thistle-shaped nozzle (Calot) attached to a hypodermic syringe, or with an ordinary urethral syringe, and films are taken at intervals thereafter. The lipiodol finds its way up to the lesion. In the case of paraplegia where there is a question of blockage of the spinal canal, the lipiodol may be injected by cistern puncture.

Examples of this use of lipiodol are given in the accompanying series of cases. (See cases II, IV, XI, XV).

Lipiodol is also used therapeutically in closed abscesses in doses up to 10 cc. The release of iodine is very gradual and it probably assists barrier formation.

Differential Diagnosis.

In general, spinal tuberculosis offers no great difficulty in diagnosis, but, if the best results are to

be obtained in treatment, it is essential that diagnosis should be made at a stage before tissue destruction and spinal inflexion become evident.

Of the symptomatic and physical evidences upon which the early diagnosis is made, Fraser⁽⁴⁾ lays special emphasis on referred pain, rigidity of the long spinal muscles with spinal fixation and the X-ray findings. The percentage of diagnostic errors is, of course, considerably higher in early stages. The history carries a lot of weight, especially as it reveals general factors of importance such as heredity, environment, familial tendency, predisposing diseases and tuberculous taints. In early stages the diagnosis depends upon probability signs which must be assessed according to their relative significance, and to the manner in which they fit into the whole frame of symptoms.

The absolute diagnosis is made in the presence of a kyphosis, of compression symptoms, of paralysis, of abscess formation, and of positive X-ray evidence, but all these appear comparatively late in the course of the disease.

I. Differential Diagnosis in Adults.

(1) Post-traumatic spondylitis (Kümmell's disease) is sometimes a source of error. It is that curious post-traumatic spondylitis which results in the collapse of the body of a vertebra previously the site of a compression

fracture, a condition which is evidently due to mechanical strain acting on bone tissues which by reason of vascular and tissue changes have formed an insufficient callus.

The history of trauma, and especially the free interval following trauma, the late appearance of pain, the gradual development of kyphosis, and, in the X-ray picture, evidence of crush or compression fracture at the site of deformity, are of importance.

In addition there is absence of general symptoms and of abscess formation.

(2) Osteoarthritis or Arthritis Deformans.

This is not a localised condition but involves larger sections of the spine and perhaps other joints as well. The hypertrophic form which may give rise to error is a disease of middle and advanced age. A kyphotic curve develops, sometimes accompanied by lateral deviation, but the deformity is more arcuar than angular. The X-ray shows the characteristic osteophytic outgrowths of bone at the margins of the bodies (bec de perroquette), and in connection with the transverse processes. The articulations between the ribs and the vertebrae show similar changes.

(3) Neuralgic and Myositic Conditions of the Spine.

Lumbago, muscular rheumatism, and the so-called myogelosis or induration of the muscles must be differentiated from spinal tuberculosis. In myogelosis there are degenerative interstitial changes seen in the muscle tissue

associated with rigidity and pain.

Progressive myositis ossificans is a more or less suddenly appearing, painful, inflammatory swelling of the muscles of the back, which results in induration and ossification. This induration might be taken for the local rigidity of Pott's disease. The X-ray picture will settle the doubt.

The X-ray picture of ostitis deformans or Paget's disease is also characteristic. It shows typical features not only in the spine, but also in the long bones and skull.

(4) Diseases of the Central Nervous System.

Certain disturbances of the central nervous system which produce sensory disturbances, atrophies and impairment of the gait, are of importance. Thorough investigation of the nervous system and the absence of vertebral changes should clear up any doubt.

Cerebrospinal syphilis and tabes are easily differentiated by blood and spinal Wassermann tests.

(5) Syphilitic Disease of the Vertebrae.

This is more sudden in onset than Pott's disease, and the progress is more rapid. The bone is early and extensively destroyed, but abscess formation is rare. Severe nocturnal pains are complained of, and some degree of angular deformity may develop. In almost all cases other evidence of tertiary syphilis is present, and this plus

the Wassermann test should keep the diagnosis correct.

(6) Actinomycosis, Blastomycosis and Hydatid Cysts are very difficult to diagnose from tuberculous disease. The characteristic sulphur granules are the diagnostic feature of actinomycosis.

(7) Typhoid Spine.

This is an acute infective condition of the vertebrae, intervertebral discs and spinal ligaments which occasionally occurs during convalescence from typhoid fever. The lumbar region is most frequently affected, and the X-rays reveal inflammatory changes in the bones, characteristic ossification of the ligamentous structures, the disappearance of the intervertebral disc and fusion of the vertebrae.

The temperature is raised and the Widal test is positive.

(8) Osteomyelitis of the Spine is a much more acute condition than Pott's disease, with rise of temperature, severe pain, and usually rapid suppuration.

(9) Luetic Arthropathies of the Spine, Tabes and Syringomyelia.

These conditions are characterised by osteoporosis of the vertebrae, spontaneous fractures and collapse, and the formation of kyphotic and scoliotic deformities. In arthropathies the hypertrophic changes are very excessive;

there are paravertebral ossifications, and ossification of the long ligaments of the articulations, which produce a characteristic X-ray picture.

There is, in addition, considerable deformity, absence of pain, remarkable preservation of the mobility of the spine and no muscular contracture.

Similar conditions are observed in syringomyelia.

(10) Spinal Neuralgia and Spinal Irritation.

Spinal neuralgia and irritation lead to muscle fixation of the spine and to functional disturbances. Hysterical spine may give rise to difficulty. It is met with occasionally in neurotic females, who complain of pain in the spine with marked hyperaesthesia on even gentle pressure over the spinous processes.

The attitude of the patient in general, neurotic or hysterical stigmata of other nature, absence of vertebral changes on X-ray examination, which would correspond to subjective complaints, should differentiate a functional condition.

(11) Root Symptoms.

Abscesses from the lumbar region may compress the roots of the 2nd to 4th lumbar nerves and give rise to violent pain in the distribution of the obturator nerve.

Root pains may simulate gastric ulcer, gall bladder trouble, renal colic, appendicitis, uterine or ovarian trouble.

(12) Tumours of the Spine.

Secondary carcinoma from the breast, prostate, thyroid gland, uterus or hypernephroma may develop in the spine.

The usual seats of the metastases are the bodies of the dorsal and lumbar spine. Angular deformity is rare; more commonly there is a massive collapse of the spine. There is uncontrollable root pain, rapid loss of weight, severe secondary anaemia, emaciation and cachexia, and the disease is uninfluenced by treatment. X-ray shows characteristic defects with very little reactive bone formation. A characteristic feature is that the disc is always intact. The primary focus is usually easily found.

Sarcoma is of even greater malignancy than carcinoma. There is a rapid development of pressure symptoms on the posterior roots, with uncontrollable neuralgic pain.

Multiple myeloma causes an arcuar kyphosis and is associated with symptoms of compression of the spinal roots. Myelomatous metastases are found to be present in other bones, the blood contains myelocytes and there is often Bence-Jones proteinuria.

Osteoporotic conditions may give rise to difficulty in diagnosis. This is found in arteriosclerosis, osteomalacia and osteitis fibrosa, but in the X-ray picture it is easy to recognise the general systemic nature of the

condition by the distribution of the lesion over large sections of the spine.

(13) Tuberculosis of the Sacro-iliac Joint.

This condition may occur as a primary affection, but is much more frequently secondary to disease in the ilium, sacrum, or lower lumbar vertebrae. It is commonest in adolescents and young male adults.

From hip disease it is recognisable by noting that the movements of the hip-joint are not restricted. It is not always possible without the aid of X-rays to differentiate sacro-iliac disease from disease of the lumbar spine, and the two conditions sometimes co-exist.

II. Differential Diagnosis in Children.

(1) Rachitic Deformities.

The rachitic kyphosis can be distinguished from Pott's disease principally by the absence of rigidity and muscle spasm, by the greater degree of mobility of the spine, and by the arcuar shape of the gibbus.

The X-ray pictures in side view show the characteristic rachitic changes and fail to reveal destructive lesions. Other signs and symptoms of rickets are usually present.

In the "wheelbarrow test" the child is lifted up by the heels. If the kyphosis is rickety, the projection disappears and the spine bends. In Pott's disease the projection remains owing to the associated rigidity and spasm.

Also the deformity in rickets develops insidiously, and there is absence of subjective symptoms and of disturbance of function.

(2) Scoliosis.

Cases of congenital scoliosis have been recorded, the deformity being due to the presence of a wedge-shaped vertebra, usually about the dorso-lumbar junction. This may give a sharp angulation, and in the X-ray a wedge formation may be interpreted as tuberculous destruction, as natural fusion, or as product of repair.

The diagnosis of scoliosis rests on the history, the recognition of vertebral anomalies, their association with other anomalies of the spine, and thorax, at different levels, as well as upon the absence of subjective symptoms and functional impairment.

(3) Tuberculosis of the Hip.

(4)

John Fraser says that most of his mistakes in diagnosis have arisen from a confusion between lumbar disease with fixation of the psoas muscle and hip joint disease.

In hip joint disease all the movements of the hip joint are restricted, flexion, extension, abduction, adduction and rotation. Rotation is most affected, because of rubbing of the articular surfaces.

In the case of psoas abscess only the extension and somewhat the outward rotation of the hip joint are affected.

X-ray should clear up any doubt.

(4) Regional Abscesses.

Psoas or iliac abscesses may be confused with femoral hernia or lipoma. The spine must be carefully examined in doubtful cases. Abscesses appearing in the groin may be of other origin, though they appear to be iliac or psoas abscesses.

Suppurative myositis of the posterior abdominal wall from metastatic infection or an infected haematoma may find its way into the psoas sheath. The same applies to infections of the kidney, especially of the lower pole.

Intraperitoneal infections of the hollow viscera or of the internal genital organs may take a similar course, also in suppurative lymphadenitis the lymph nodes lying between the level of the 2nd lumbar spine and the bifurcation of the aorta may break down into the psoas sheath.

(5) Spondylitis Deformans Juvenilis.

(31)

Scheuerman published an article on this disease, which is due, in his opinion, to alteration in growth of the vertebral epiphysis. Certain of these cases ultimately develop mild kyphotic deformities with compensatory curves. If they do so, confusion in diagnosis may arise, but X-ray usually clears up the doubt, showing fragmentation of the epiphyses, and changes in the epiphyseal line. Pain, except in the early stage, is the exception.

(57)

Recent researches by Schmorl are all much against the supposition that the wedge-shape of the vertebral bodies in this disease is due to deficient growth at the epiphyseal line. It may now be regarded as certain that the epiphyses of the vertebral bodies have absolutely nothing to do with any growth processes. The epiphysis is purely a fixation organ, and has an important function, not in the development, but in the architecture of the spine. The peculiar disc prolapses met with in the lower dorsal and lumbar regions of youthful spines most probably account for the characteristic peculiarities of Scheuermann's radiograms.

(6) Osteochondritis vertebralis of Calvé

This is a peculiar destructive and absorptive process within the vertebral bodies seen at an earlier age than epiphysitis, and leading to wedge formation of the vertebrae.

In the X-ray picture, in striking contrast to the findings in Pott's disease, an absolutely intact condition of the adjacent intervertebral discs above and below the diseased vertebra is found.

Case XII of the accompanying series is an excellent example of a modified form of osteochondritis vertebralis at first thought to be a typical case of Pott's disease. See radiograms of this case, which were sent to Calvé.

PROGNOSIS.

Mortality Statistics.

In whatever way you look at it Pott's disease is a problem of a particularly difficult type - the long duration of treatment, the uncertainty which must constantly attend our efforts, the liability to such serious complications as paraplegia, the crippling which to some extent is inevitable, the mortality, both immediate and remote. ⁽⁴⁾
(32)

An impressive paper was published by Leskinen in 1924; 220 conservatively treated cases of Pott's disease were considered. 137 cases were traced and investigated. The total mortality was 40.5% In the male cases it averaged 50%, in the female 32.1%. The highest death rate occurred in the first two years of the disease (74.9%); and in respect of age the figure was highest in cases under 20 years, and lowest between 20 and 30. Complete recovery was obtained in 30.4% of all cases.

Fraser's own investigations on a modest scale are generally in agreement with the above figures.

(8)

According to Steindler one of the most important factors in Pott's disease is age. The outlook changes rapidly for the worse as adult or middle age is reached.

The value of the general statistics on the mortality in Pott's disease differs according to the individual manner of arriving at the statistical data, and also according to the individual types of treatment favoured by the several observers.

Some of the most authentic mortality statistics give the following figures:

(33)
 Vulpius for the cervical region 16%, for the dor-
 (34)
 sal 28%, and for the lumbar spine 7% mortality; Vacchelli 16.5% in all cases. The highest mortality is shown in the cases complicated by paraplegia, namely 43.5%, then follow the types of hereditary tuberculosis with 18%, then the cases complicated with abscess formation with 17.10% mortality.

The highest mortality percentage is seen in middle age and in cases of longer duration. This is not strange since pathological examination shows that the repair of the diseased focus in adults never reaches the point of thoroughness seen in children.

Immediate Causes of Death.

Most frequent among these ~~are~~ recrudescent phthisis and tuberculous meningitis, the former more often seen in adolescents and adults, the latter in children.

Next in importance is paralysis. Steindler observes that paralysis, if not curable, sooner or later leads to death by development of bed sores and their attendant sepsis, or bladder and kidney troubles following urinary difficulties.

In general, "closed" tuberculosis, i.e. without communicating abscesses or sinuses, offers a much better outlook for life than cases in which these complications exist.

Prognosis as to Cure.

Cures are given at various percentages ranging from 85% (Rollier) to 30%.

One difficulty in arriving at accurate percentages of cure lies in the difficulty of differentiating between recrudescences of existing conditions and true recurrences. (8) Steindler gives a recurrency rate of 15%, allowing a period of two or three years of complete quiescence of symptoms as sufficient for the arrest of the trouble.

The highest percentage of cures, under conservative treatment, is obtained in uncomplicated cases of cervical caries (Steindler). This percentage falls considerably when complications, abscess or paralysis, are present. The presence of sinuses and mixed infection is unfavourable.

In general, the outlook for cure in tuberculous spondylitis is not unfavourable. Steindler states that -

(1) Simple cases with an original focus which is limited in extent have an average duration in the cervical region of two years, in the dorsal of three to four, and in the lumbar of four to five years. The theoretical reason for this is that the strain on the lesion is greater the lower down in the vertebral column it is situated, but the cases investigated in Millport force one to the conclusion that the duration of the disease is as a rule shorter in the lumbar region than in the dorsal. See Case XI for short duration of treatment in lumbar Pott's disease. He is

typical of many others, and at the present moment he is an apparently fit man in charge of several "chain stores" in New York.

(2) In cases complicated with abscess the determining factors are: the region of the spine involved, the age of the patients, and whether the abscess remains "closed" or not.

Cases complicated with abscesses, not perforating, usually have a good prognosis in children, especially in the higher regions of the spine where the size of the abscess is less.

On the whole, the lower the seat of the disease, the greater is the tendency to abscess formation and the greater the amount of abscess material produced. The favourable prognosis for the closed abscess has the following exceptions: (a) in the cervical spine the retropharyngeal abscess renders the prognosis unfavourable; (b) in the dorsal spine the retromediastinal abscess is a serious complication because of its effect upon the mediastinal structures, and upon the spinal cord; and (c) in lumbosacral tuberculosis the retroperitoneal abscess gravely compromises the outlook because of its effect upon the structures of the peritoneal cavity.

The prognosis of perforating abscesses is much graver and more so in adults than in children. The mixed infection increases the danger principally in those abscesses

which, by their localisation, become difficult to control, especially the retroperitoneal abscess which tracks into the gluteal region and surrounds the hip-joint. Many of these cases prove fatal.

Prognosis as to Deformity.

A certain proportion of cases heal without deformity, mostly the epiphyseal type seen in adults.

In these cases the telescoping is not accompanied by angulation and results merely in a shortening of the spine.

In the majority of cases, however, a deformity develops in the form of a gibbus.

(35,36)

Ridlon believes that cases treated with sufficiently long recumbency can be cured without increase in the kyphosis, that cervical disease, unless kyphosis is of long standing, can be cured without deformity, and that, as a rule, a very considerable degree of normal mobility can be obtained. In dorso-lumbar disease considerable reduction of the deformities can be obtained by prolonged recumbency. In upper dorsal disease the curvature is likely to increase under any form of treatment, and, in these cases, prolonged recumbency is especially essential.

The factors upon which the prognosis as to deformity depends particularly are (1) the location of the disease, and (2) thoroughness of the treatment.

A deformity which is not yet consolidated can be fully corrected in the cervical spine and can be reduced in the

dorso-lumbar region, but in the upper dorsal spine, as a rule, some deformity results. If the diagnosis is made before deformity has occurred, and if proper treatment is consistently carried out, deformity may be prevented in most cases, and the duration of the disease thereby greatly shortened. Ridlon believes that no case should be under treatment and observation for less than three years and in many cases five years or longer.

The contrast between cases properly treated and cases abandoned to medical treatment alone, or to no treatment at all, can be seen in some statistical reports, in which the death rate mounts to over 25%, and the cures fall below 50%. In contrast to this Rollier claims 85% of cures with conservative treatment, particularly recumbency and heliotherapy.

Prognosis of Paraplegia.

The prognosis in the great majority of spastic cases is favourable, because compression paraplegia is mostly moderate in degree and because it readily responds, as a rule, to recumbency.

This applies particularly to children in whom adequate and prolonged recumbent treatment is nearly always successful.

In adults, however, the prognosis of paraplegia becomes much worse, since it does not yield so readily to treatment.

Some of the cases not relieved by recumbency improve after a decompression operation; but even with operative procedures there remains in adults still a considerable percentage of cases not relieved.

One group of statistics, embracing 110 cases of paralysis, shows 58, or 52.7% cured, including the severest form of paralysis in children, as well as in adults. (38)

Of 74 cases reported by Gibney, 77% were cured or improved. (37) While the severest form of unrelieved paralysis almost invariably leads to death, many of the milder cases may persist indefinitely, the patient showing exaggerated reflexes, a certain weakness of locomotion, ataxic gait, and easy fatigue.

TREATMENT.

I. Historical.

The earliest treatment on record is that depicted in the Greek Anthology, translated by W.R. Paton, ⁽³⁹⁾ in which this passage occurs: "Socles, promising to set Diodorus' crooked back straight, piled three solid stones, each four feet square, on the hunchback's spine. He was crushed and died, but he had become straighter than a ruler." Comment is unnecessary!

In the sixteenth and seventeenth centuries there were certain superstitious practices such as the "King's Touch", and an occasional reference to an attempt by force to wrench straight a crooked spine.

Pott tells us that in his day "recourse is always had to steel stays, the swing, the screw chair, and other pieces of machinery in order to restore the spine to its true and natural figure; but all, as far as I have observed, to no real or permanent good purpose They are all, from the most simple to the most complex, but particularly the swing and the screw, calculated to obviate and remove what does not exist. They are founded upon the supposition of an actual dislocation which never is the case, and therefore they always have been and ever must be unsuccessful."⁽¹⁾

Pott states that his attention was directed to "this distemper by its occurring in the person of a very promis-

ing youth of fourteen years old, with whose family I was nearly connected", and that while the subject was in his mind he happened to be at Worcester "and in a conversation with the late Dr. Cameron of that place I mentioned to him my opinion that previous both to the paralytic state of the legs and to the alteration of the figure of the backbone, there is a predisposing cause of both consisting in a distempered state of the ligaments and bones, where the curve soon after makes its appearance. The doctor concurred with me, and said he remembered some years ago to have noted a passage in Hippocrates in which he speaks of a paralysis of the lower limbs being cured by an abscess in the back or loins."

Pott determined to try the treatment on his next case. "I made an issue by incision on one side of the projection and gave strict charge to the mother to take care that the pea was kept in At the end of about three weeks or a month the child was manifestly better and began to make use of its legs."

Encouraging results followed in the case of other of his patients afflicted with the same "distemper" and "within these last six or eight months several cases of curved spine have been received into St. Bartholomew's Hospital, where they have been seen by great numbers of the profession. The novelty of the treatment and the success which has hitherto constantly attended it has

necessarily engaged the attention of many, and occasioned some observations on the subject. The patients whom I have attended in the early part of the distemper of whatever age, have all got well; that is, have not only regained the use of their legs but have become healthy and fit for any exercise or labour, as numbers can testify who have seen them daily. Most of them have become much straiter, some quite strait, and all of them perfectly free from all kind of inconvenience arising from the curve." Truly very satisfactory evidence of cure, even in these enlightened days!

There is no doubt that Pott was perfectly honest in his belief, but the whole train of argument shows that he was relying entirely on empiricism, and that, having a firm belief in the efficacy of counter-irritation, he made no effort to seek for any other cause for the improvement. He did not take into consideration the curative effects of rest whilst the patients were in hospital, nor did he make a careful post mortem examination of the diseased tissues, for he contented himself with a mere examination of the vertebral column. However, the doctrine of physiological rest was not enunciated for nearly one hundred years after his death. He carried it out empirically, and in so doing displaced for ever the ambulatory system, and the use of the complicated mechanical apparatus which had been a torture to many unhappy patients.

In 1882 Robert Koch made public the results of his investigations into the germ theory of the disease, and proved conclusively the constant presence of an invading bacillus in the lesions. By this fact he converted a vague indeterminate condition into something definite, comprehensible, and finally, preventible by hygienic and public health measures.

During the past century many changes have taken place in the treatment of tuberculous lesions, owing to the different conceptions which have been held as to their nature and evolution.

Three chief epochs may be considered:

(1) The time before Pasteur's great discoveries. During this period, in the total absence of any conception of sepsis and asepsis, treatment was almost futile. The certainty of the consequences of infection prevented rational attempts at surgical interference. David stated: "I have always observed that patients die in whom an abscess has been opened."

(2) With the works of Lannelongue in France tuberculous disease of bone became clearly defined and known to be the result of primary infection and subsequent destruction of tissues by tuberculous elements advancing much as does a neoplasm. Thus was evolved the radical treatment which, supported by the recent discoveries of antiseptics, consisted in the total removal of the infection by extensive

surgical interference - incision of the abscess and excision of its source of origin. In spinal caries it was often impossible to excise all the bony tissue invaded by tuberculous disease. The operations which required these extensive excisions were followed by surgical shock, which could not be stood by all the patients, and gave deplorable orthopaedic results.

(3) Following Koch's great discovery there dawned a less daring and less radical surgical period, which represents the recognised practice of today. Extensive surgery was replaced by the two essentials of rest to the affected part and general building up of the body tissues.

The institution of national schemes of medical insurance, of school inspection, of welfare work, and compulsory notification of the disease have led to cases being brought to light much earlier, and treatment being instituted correspondingly early.

Now it is comparatively rare for patients to attend for treatment with the crooked spines which were once looked upon as the hallmarks of the condition. (40) Calot says that "up to within the last third of a century Pott's disease culminated in a lamentable hump or death, the latter being often the most enviable termination..... Nowadays Pott's disease has ceased to be as truly lamentable, and terrible a disease if properly treated, for it almost always ends in recovery, usually integral recovery. Thirty-five

years ago abscess meant surgical incision with curettage, fistulisation and death. Paralysis also was held to be amenable to operation, but this operation even now is followed by death. As for the hump, not only was it regarded as incurable, but it was sacred, not to be touched - taboo. Anathema to the temerarious person who dared to lay hands upon it in the endeavour to correct it."

No doubt this picture is somewhat overdrawn, but it contains the essential points in which treatment has advanced in the last thirty years.

Every year the mortality and the suffering from the disease diminish. In America it has been estimated that, if the rate of decline in mortality is maintained, tuberculosis will have ceased to be one of the great scourges of mankind in the Registration States by 1950. In the non-pulmonary form the reduction in mortality has far exceeded in rate the reduction in incidence.

In Scotland the preventive side of bone tuberculosis has not been sufficiently dealt with. As already shown, large percentages of spinal cases are bovine in origin. These cases have to be treated in institutions for prolonged periods, entailing a big expenditure of public money, while the Government allows milk to be used which is neither Pasteurised nor from Tuberculin tested herds.

The Government has made all local authorities responsible for the cases which are found in their area. It is

better for tuberculous patients to be treated in special hospitals, as they can receive treatment adapted to the peculiarities of their infection, also prolonged care or follow-up treatment, and it may be possible for them to continue their schooling if they are children, or take up some occupation under medical guidance if they are adults.

The application of the principles of institutional care under specialised hospital conditions is illimitable. Conservative measure should be carried out with the same rigour as the details of technique of a surgical operation, if we would reduce the invalidity from any tuberculous condition, reserving operation for particular instances and conditions, and in every case following up such operations with treatment for long periods until arrest of the process is fully assured.

II. General Treatment.

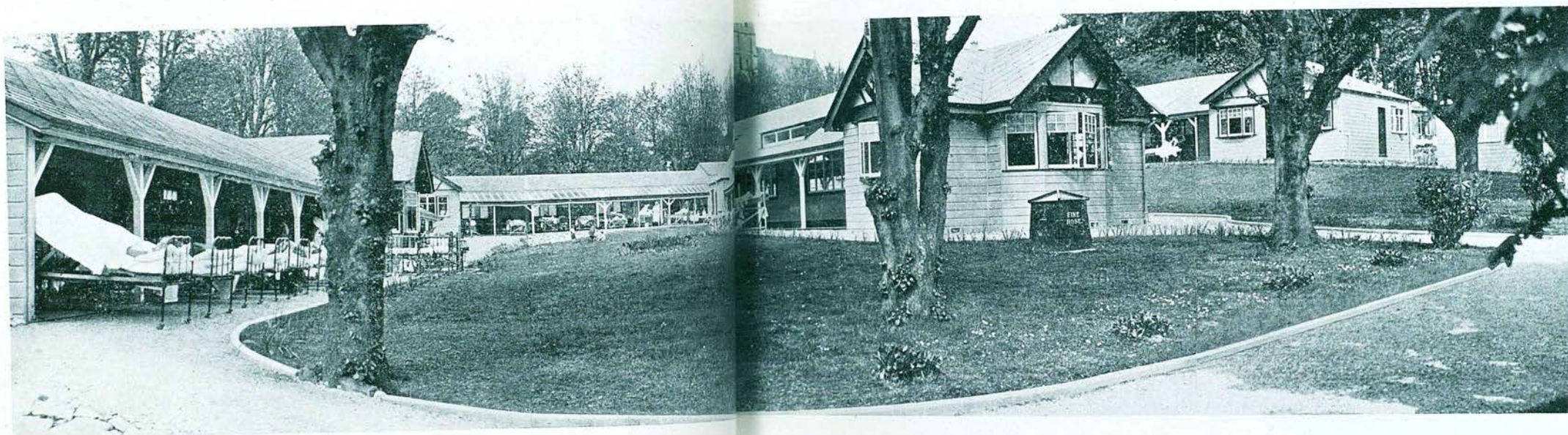
A. Dietetic.

The diet must be adapted to fit the need of the particular type of treatment.

Food should be both regular and plentiful. If the patient is in recumbency, starchy food should be restricted, but milk and eggs given in abundance. Meat should be given in moderate quantities only. Above all, the food should consist of milk, cereals, cream and fruit.

The main meal should offer some meat, at least two vegetables, possibly three, rich in cellulose, some fruit

The
“Home”



and cereal. For the evening meal, milk, also cereals and fruit, can be recommended.

As a rule, tuberculous children should be kept on a higher protein allowance than normal children, but there is no reason to increase the carbohydrates beyond what would be appropriate for a bedfast patient. The general nutrition may be further improved by olive or codliver oil or by some of the malt extracts. As a tonic to stimulate the appetite, syrup of ferric iodide or of iron, quinine and strychnine is useful.

For elimination, mineral oil given at bedtime, and ample fluids and fruit juices are usually sufficient. Only occasionally will a stronger laxative be required.

The following is a specimen diet sheet in Millport.

January 1933.

Weekdays

Breakfast: Porridge and milk.
Tea, bread and butter. Rolls.
Eggs, boiled or scrambled. Sausages.
Fish, Herring.

Dinner: Soup (older patients vegetable stew).
Steamed pudding. OR Mince, OR stew
OR cold meat OR sausages.
Potatoes. Vegetables.
Milk pudding with fruit.

Tea: Tea. Bread and butter. Teabread.
Jam or syrup.

Supper: Tea or cocoa. Bread and butter,
OR milk.

Sundays.

Breakfast: Porridge and milk. Tea. Bread and
butter. Fried bacon and egg.

Dinner: Sausages and potatoes. Vegetables.
Milk pudding and fruit.

Tea: Hot pies OR sausages rolls.
(In summer, hot pies discontinued,
Cheese. Lettuce and biscuits substituted.)

Special diets as ordered: Fish, jellies, eggs,
tripe, liver.

B. Hygienic Treatment.

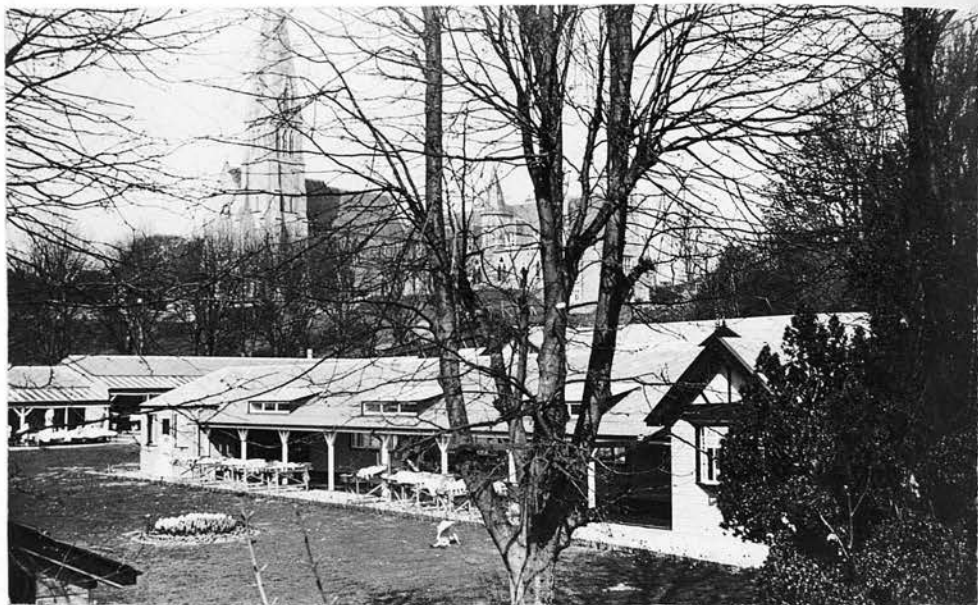
Exposure to air and outdoor life is such an obvious advantage to the general state of health that it hardly needs emphasis.

The systematic exposure of tuberculous patients to the sun, however, based upon modern and scientific principles, has only recently developed into a powerful factor in the plan of treatment.

C. Heliotherapy.

Rollier's effort to develop sun treatment as a standardised method dates back to 1902, when he introduced it in the high altitudes of Switzerland. Today it has won for itself a definite place in the treatment of surgical tuberculosis and has come into general recognition.

The best known action of the sun is that upon the skin where it produces pigmentation, principally produced by the ultra-violet rays. Patients who acquire pigmentation easily, respond more favourably to insolation, and better



General view of part of St. Andrew's Home,
Millport, showing heliotherapy.



Close up view of above.

results are usually produced in brunettes than in blondes.

If insolation is overdone, it may lead to disturbance of the temperature centres of the brain and produce sun-stroke, especially under exertion. The symptoms of over-insolation are dry and burning skin, strongly overheated face, fatigue and headache.

Heliotherapy is most effective in the high altitudes and clear air of Switzerland, but is being increasingly used in this country. The accompanying photographs of Millport Home show patients having heliotherapy. The patient is started at five minute periods of exposure as follows: on the first day the legs are exposed for five minutes, on the following day ten minutes exposure is given to the legs and five minutes to the thigh, on the third, five minutes to abdomen; then, ten minutes to the thigh, and fifteen to the leg, etc. on successive days, until the patient becomes entirely tolerant to the insolation of the whole body. After he has been insolated for an hour or an hour and a half a general insolation throughout all the hours of sunlight can be carried out.

The precautions necessary to avoid untoward complications during insolation are proper control of pulse and temperature, protection of the head, the application of cold bandages and the administration of ample fluids. Patients complaining of dizziness or headache must be taken inside.

The patient is held recumbent either in the dorsal or the ventral position.

In the dorsal position he is placed flat upon a hard mattress. A ring cushion is used for the support of the pelvis and a second for the lumbar lordosis. A small cushion is also placed under the patient's head.

The ventral position is adopted after a few weeks of sun treatment, when the pain has disappeared. The position assumed during the day gives sufficient repose for the spine and removes completely the pressure of body weight; it favours also the formation of compensatory lordosis, and permits insolation of the whole back. A cushion is inserted under the chest and gradually increased in width, thereby increasing also the lordosis above and below the deformity. A prominent gibbus in the lumbar or dorsal spine may be corrected by this procedure, and in early stages of spondylitis, deformity may thereby be prevented.

Under this treatment one gradually sees an erythema of the skin appear as the first sign of reaction. It is rapidly followed by tanning of the skin. The general condition visibly improves, pain disappears, and swelling and abscess formation frequently subside. In the X-ray one sees the contours of the vertebrae becoming sharp and distinct, bone production increases as a sign of healthy repair, and the healing process is greatly aided by the functional use of the muscles.

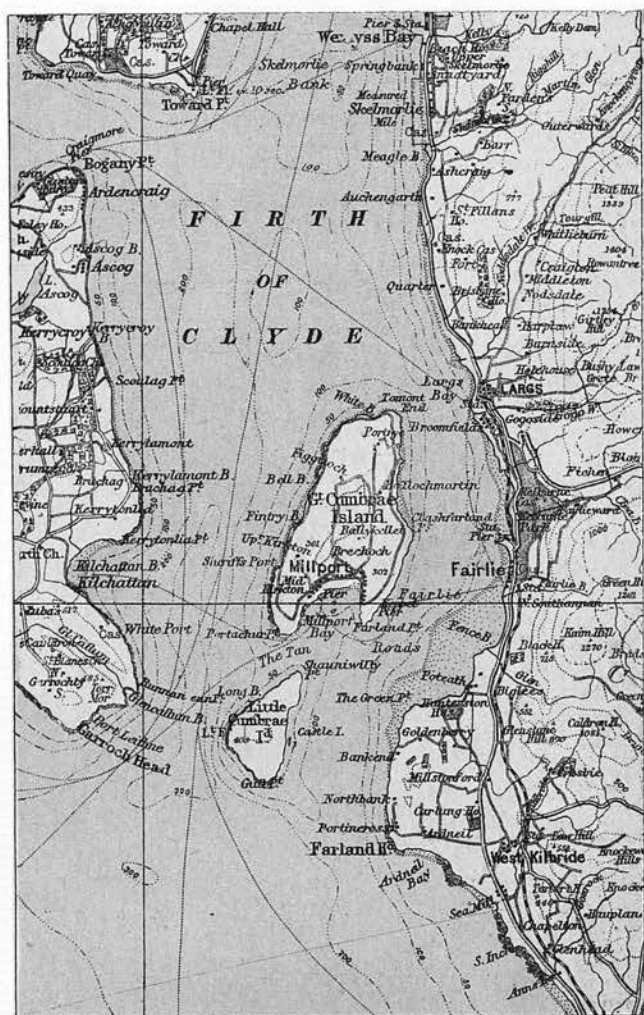
Remarkable results are obtained by heliotherapy and recumbency, in the conservative treatment of spinal tuberculosis.

The time element should not be stressed too much as an argument in favour of operative treatment, as it is becoming more evident that all operative procedures, to be safe, require also a long period of conservative after-treatment. Two, three and even more years are spent by patients in Rollier's clinic. The decision of completed cure rests upon the X-ray evidence. In tuberculosis of the spine the vertebrae must show clearness of outlines and details of texture, as well as complete bony blocking of the affected vertebral bodies before repair may be considered complete. (41)

Heliotherapy has brought the high mortality figures of earlier statistics (Vulpis 34%, Mohr 40%) down to a remarkably low level. Rollier's statistics show 85% cured in children, 78% in adults.

In America reports from all sources testify to the efficacy of this form of treatment, though the results do not quite equal those of Rollier.

As an adjunct to conservative treatment, heliotherapy is of inestimable value, yet, however great its effect may be on the general condition, the disappearance of abscesses, and the promotion of processes of repair, it must never be allowed to supplant other orthopaedic measures,



(42)

especially recumbency and immobilisation.

D. Artificial Sunlight.

Ultra-violet ray in the form of a mercury vapour lamp is being used as a substitute for sunlight in surgical tuberculosis in general. In therapeutic effect artificial sunlight is doubtless inferior to the chemical rays of the sun, but during the winter months and in unsuitable climates it is an acceptable substitute. In surgical tuberculosis a certain local effect is noticeable; swellings subside, sinuses, after becoming more profuse in drainage, often clear up and close. There is also a decided influence upon local pain. The general effect of this type of treatment is less noticeable.

E. Maritime Treatment.

The beneficial effect of sea air and sea bathing has been known for years, especially if combined with heliotherapy. This has led to the establishment of large sea-side hospitals for the treatment of surgical tuberculosis, e.g. Hayling Island, Margate, Berck and Zuydcoote. This advantage is also possessed by Millport, whose maritime site is well shown in the accompanying map.

F. X-ray Treatment.

The treatment of surgical tuberculosis by X-ray is not generally recognised.

G. Tuberculin Treatment.

In general, the therapeutic use of tuberculin for spinal tuberculosis has been abandoned, because of the discrepancy of reports and because it is, in efficient dosage, not without risk to the patient.

With improvement in the technique of administration, and with more efficient control, however, the beneficial effect of tuberculin in surgical tuberculosis may yet become established.

H. Educational and Occupational Treatment.

Modern educational methods adapt themselves to bedside teaching and have been introduced in most large institutions for the treatment of surgical tuberculosis.

The same is true of occupational therapy, both for the recumbent and for the ambulatory patient. It develops inclinations and often discloses natural gifts. In Millport a school sister, who is also a trained nurse, looks after the education of the children, and also superintends the instruction of the adults in raffia work, etc.

III. Local Treatment.

The ideals which underly local treatment are: ⁽⁴⁾

- (1) Fixation of the affected region until the process of healing is complete, with relief of pressure from muscle spasm.
- (2) The limitation of the degree of the angle of inflexion.

- (3) The avoidance, if possible, of the complications of cold abscess formation and paraplegia.

Between the last two statements there is a corollary which it is important to recognise - that it is inflexion as a mechanical force which is responsible for the dissemination under pressure of the caseous debris, that is, for the migration of the abscess.

Rest and recumbency have a greater share in the treatment of tuberculosis of the spine than in any other form of surgical tuberculosis. They also constitute the most important phase in the treatment of spinal tuberculosis itself.

A. Recumbent Treatment is indicated -

- (1) in all cases with pain or distress, night cries, marked impairment of general health, elevation of temperature and loss of appetite.
- (2) in cases with increasing deformity, or rigidity and spasm of the back muscles.
- (3) in all cases with developing and increasing superficial abscesses.
- (4) in all cases showing signs of spinal irritation or compression.

The tendency to increase the period of recumbency more and more, at the expense of the ambulatory treatment, is gaining ground.

(43)

Dr. Gordon Pugh states that his experience has led him to believe that the consequences of too short a period

of recumbency in the treatment of Pott's disease were more serious than was generally realised; it was his opinion that confidence in the weight relieving properties of a spinal jacket contributed to decreasing the period of recumbency, and that such confidence was unfounded. It was his policy to keep the child on its frame until it was certain that the disease was quiescent. In severe cases this might involve a period of three years' recumbency. Yet that this was justified was indicated by the fact that, from 1922 to 1928, only ten spinal cases that had previously received treatment were readmitted with any recurrence of symptoms. Spinal cases were treated on a special spinal frame and carriage. These carriages were light and easy to wheel, and greatly facilitated visits to the artificial sunlight department, etc. - the Carshalton Carriage.

The objective of treatment on the spinal frame is to hide the hump in the back by the production of a compensatory curve in the spine above and below it. The consolidated area forms once more a reliable weight-bearing segment of the spine. The object of the spinal jacket is to prevent flexion compression, and to maintain the compensatory curve as the child grows; as growth occurs the hump often becomes practically inconspicuous.

Dr. Pugh advocates the nursing of cases of Pott's disease in the prone position. This position is said



Two views of the Bradford - Whitman Frame

to be very much more comfortable for the patient, because the weight of the viscera is removed from the diseased area, the muscle wasting which follows rest in the supine position is avoided, and collapse can be limited by hyper-extending the spine to any desired degree. Nursed on their faces, the patients can feed themselves, read without eyestrain, and use their arms without stress or strain to the vertebral column.

Adults can be safely left prone without a retaining apparatus, but children usually require a controlling frame.

Recumbency is, as a rule, combined with reclination or traction, or both.

(1) Reclination is a position of hyper-extension of the back which produces compensatory lordotic curves above and below the seat of disease. This is accomplished by suitable frames, for instance, the gaspipe frame of Bradford. The body, placed in hyper-extension by the proper curving of the frame, is fastened to it by straps or belts.

(2) In order to make the immobilisation secured in recumbency still more effective, it is combined with traction. Traction to the head is applied, by means of the so-called Glisson sling, to the legs and pelvis by adhesive straps or a pelvic belt. Ropes with weights attached to them are run over pulleys fastened to the ends of the bed. The traction applied to limbs and pelvis may serve

as countertraction to that applied to the head and vice versa; or, countertraction to the head may be furnished by the weight of the body, if the head end of the bed is raised on blocks; or, the upper part of the body serves as countertraction to pelvic and leg extension, if the foot end of the bed is raised. In high dorsal or cervical disease, the upper end of the frame is sharply curved, so that the overhanging head, by its own weight, furnishes the countertraction.

The advantages of recumbency treatment are complete elimination of weight-bearing and a satisfactory, though not complete, degree of elimination of spinal motion.

The advantage of reclination is, in addition, that it produces a mechanical countereffect to the deforming tendency of the disease by forcing the spine into hyperextension.

The advantage of traction is that it relieves muscle spasm and contractures, and contributes to the immobilisation of the spine. It further relieves, indirectly, pressure upon the spinal cord. All have the advantage that they can be carried out in the open as well as indoors.

Careful attention during the period of recumbency is required to the diet and skilled nursing is necessary for the prevention of chafing and pressure sores.

Details in Technique.

In Millport the dorsal position is used for the greater



Close up view of child on Berck Tray,
showing details of tray and
method of fixation. Note boots
to prevent foot-drop.



Case X, lying in plaster half-shell,
showing details of shell.

part.of the recumbent period. The objection held there against the prone position is that neither the thoracic nor the abdominal wall is a rigid structure and that therefore efficient immobilisation, which is the most important thing to secure, cannot be attained satisfactorily in the prone position.

There are many different methods in use for the treatment of the recumbent stage, but I shall confine myself to describing the method followed in Millport.

Pott's disease in children is treated on a Berck tray (photograph). Shoulder straps fixed to the sides and the top of the bed prevent the child slipping down, while the feet are enclosed in boots fixed by the soles to a wooden bar at the foot of the bed, to prevent footdrop. A sand pillow is placed below the gibbus. In this way hyperextension of the spine is produced, also traction and countertraction, without the use of plaster jackets or complicated frames.

Plaster shells are not used under the age of ten.

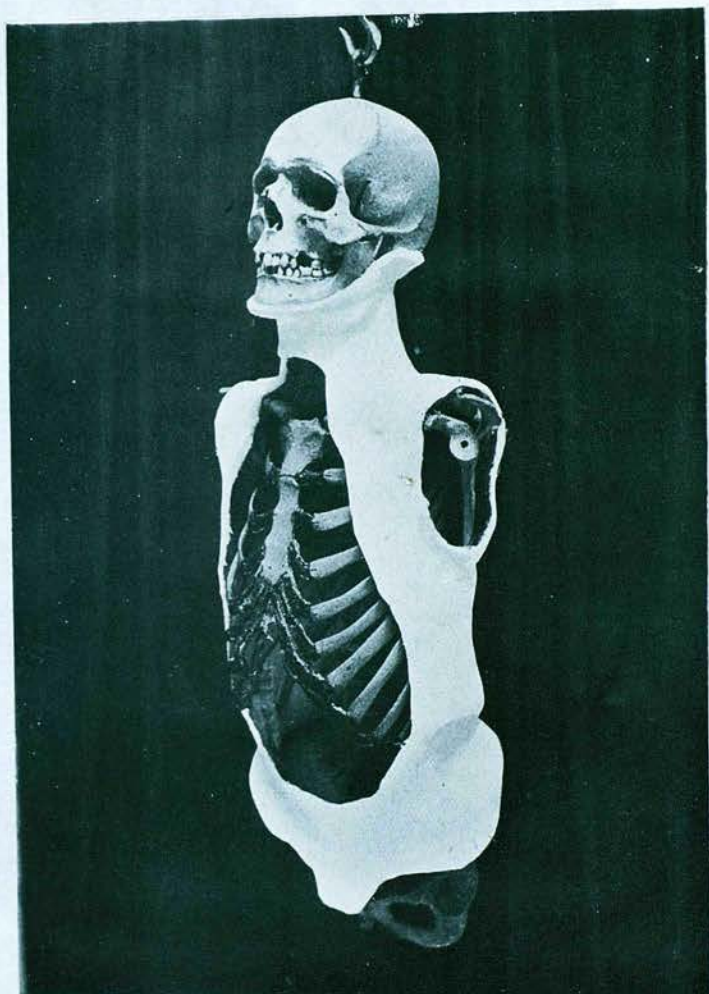
In adults the plaster half shell is used on a bed with fracture boards (photograph). The whole shell has been given up as being uncomfortable, difficult to keep clean, and offering no advantages over the half-shell.

The plaster half-shell is made as follows:

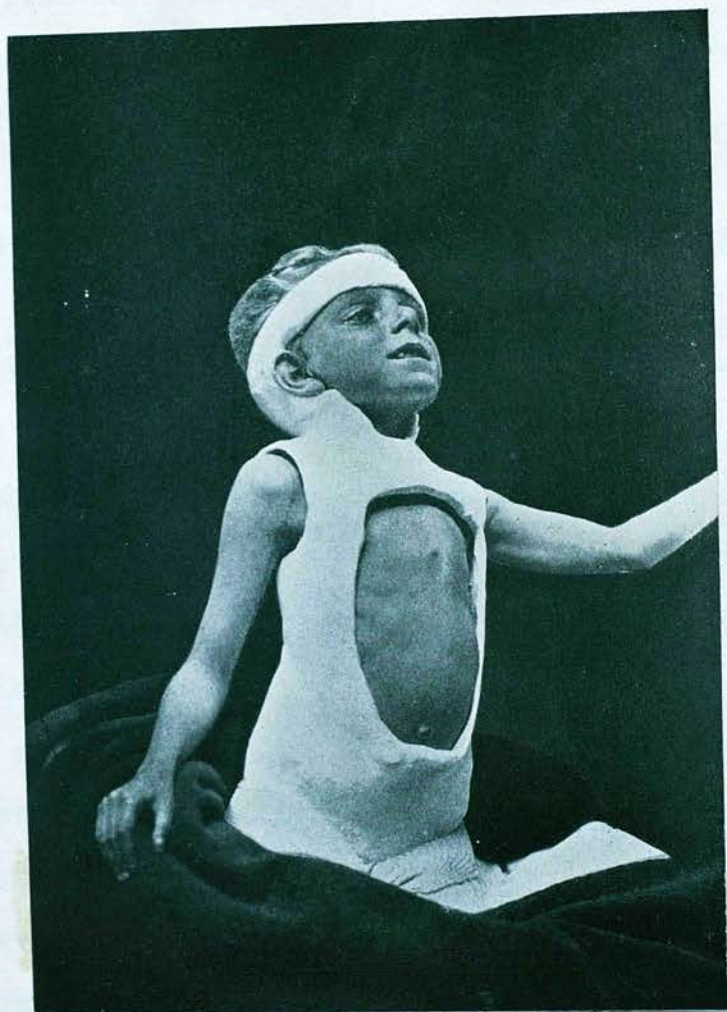
The patient is fitted with stockinette of suitable width and put in the prone position on the table, support-



Applying plaster to head.



"Minerva" completed on skeleton to illustrate bony points about which jacket should be moulded.



The "Fillet" applied to a patient with cervico-dorsal caries. This patient was admitted with complete paraplegia and incontinence of urine. Six months later she had recovered the use of her legs, was no longer incontinent, and a plaster jacket "Fillet" had been applied. In the illustration shown, she is not yet able to sit up without some assistance. Note the ample space allowed for respiration and digestion, and the freedom of the shoulder girdle.

ed by pillows under the chest and thighs to give hyper-extension.

Then plaster bandages are wound from side to side over the patient's back until a sufficiently thick shell has been formed.

This is allowed to set, the stockinette is cut off up the centre of the ventral surface of the body, and the half-shell lifted off. After it is thoroughly dried, which takes 2 - 3 days, all the edges are trimmed up with a saw, and the shell fitted to the patient.

The outside of the shell is celluloided, so that it can be kept clean, and webbing straps are rivetted to the shell so that the patient can be strapped into it.

Cervical disease is treated as follows:

(1) In acute stage head extension with webbing straps as described in Case XVII.

(2) During early quiescence a Minerva plaster, including the head, or a "Fillet" (see photographs).

(3) When healed a celluloid collar (doll's collar).

During the last 3 - 6 months of recumbency the ventral position is used during the day.

Duration of Recumbency Treatment.

It must be continued until the acute stage is past, until the fever has disappeared for a certain length of time, until there is no pain, and no development of abscesses, until there is no sign of spinal compression, until



Boy wearing celluloid
jacket



Same boy without jacket



Ventral position on spinal board.
Note triangular pillow

the general condition of the patient is satisfactory and until the local examination of the spine shows a sufficient degree of consolidation. On the average it is found that adequate treatment of spinal tuberculosis requires two years in the dorsal decubitus, followed by three to six months in the ventral position during the day, before a satisfactory stage of recovery is reached so that ambulatory treatment can be taken up.

B. Ambulatory Treatment.

The aim of ambulatory treatment is to eliminate motion and flexion of the spine as completely as possible by the application of a rigid retentive apparatus.

Indications for ambulatory treatment are the absence of the conditions which were mentioned before as indications for recumbency treatment.

Plaster casts and braces are generally constructed on the plan to give support to the spine in the back and to be braced in front against two fixed points, one at the shoulder girdle and the other at the pelvis.

In Millport celluloid corsets of the Carshalton type are used during the ambulatory stage and must be worn for a minimum of one year, but often much longer.

The technique now followed in the making of a celluloid jacket is as follows:

In taking a cast the skin is lubricated to prevent the



Cast of patient with
severe gibbus



Removing celluloid



Finished Celluloid Jacket



Child wearing celluloid
jacket.

plaster adhering to the skin. Then bandages are wound round the patient and allowed to set, taking care that the patient is in good hyper-extension.

After the plaster has set, but not hardened, it is cut off, a piece of flat rubber having been placed along the line of cutting next the skin, and one end is closed with a plaster bandage, thus forming a receptacle.

This receptacle in turn is lubricated inside and filled with plaster.

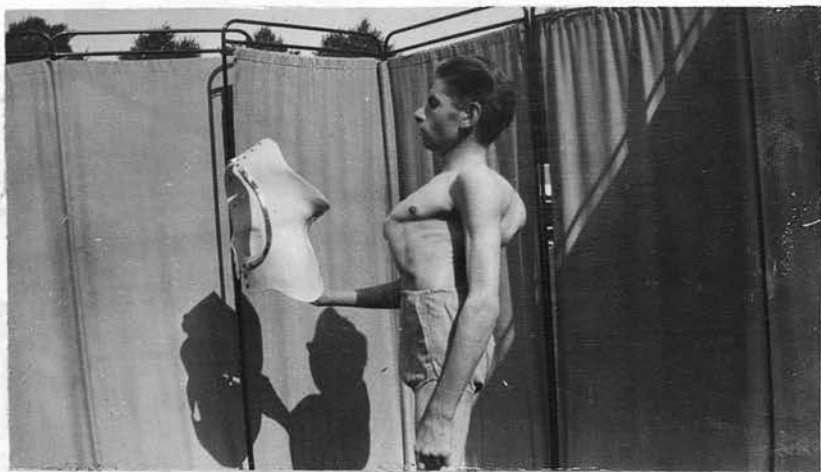
When it is set, the outside cast is cut off, leaving the "positive" cast, the exact form and shape of the body.

Three layers of stockinette are put on the "positive" cast, then successive layers of muslin are painted with celluloid paint (celluloid shavings dissolved in acetone) until the desired thickness is attained.

Then the jacket is cut down the middle of the front, fitted to the patient, and all edges trimmed. The edges are then rounded and celluloided, and eyelets are fitted with laces for lacing-on purposes.

In the case of a marked gibbus, the jacket is made to fit under the gibbus only, while in front it is taken well up over the sternum so as to retain hyper-extension.

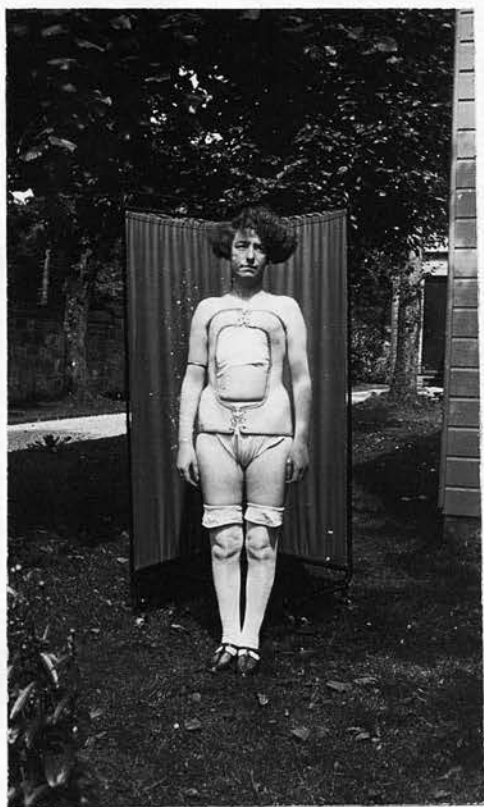
A celluloid corset so made and fitted to the patient forms an absolutely rigid though not uncomfortable splint, which is also very light and washable.



Case with severe gibbus, showing celluloid jacket ready for application.



Same case wearing the jacket



Front view of celluloid jacket

C. Treatment of Abscesses.

Abscesses in Pott's disease should be treated conservatively as long as possible. Absorption under treatment by rest and recumbency may be expected in a large majority of cases. As long as the abscess remains subcutaneous, septic infection can only occur through the blood stream, which is a possible, but not a probable occurrence.

(1) Intervention in a tuberculous abscess is therefore refrained from unless it assumes a superficial character or threatens to perforate. This occurrence should be prevented by the puncture of the abscess. The puncture is carried out by introducing into the cavity a fine trocar under special aseptic precautions, and in a manner which will prevent the development of a direct channel of communication. To effect this the skin over the abscess is held taut while the trocar is introduced in an oblique direction away from the point of the abscess which threatens to perforate, so as to make the canal as long and as oblique as possible in the subcutaneous tissue. This process is called "valving". Then, when the abscess is evacuated - facilitating this by gentle pressure at the periphery - the trocar is withdrawn, the abscess is sealed, and a dressing of dry gauze is applied. Great care must be taken to ensure absolute cleanliness and asepsis. In the course of time the abscess refills and then the manoeuvre has to

be repeated. When the abscess contents appear too thick to evacuate by aspiration, a short incision may be made and the abscess cavity emptied of its semi-fluid contents: after this it must be carefully sutured and covered with sterile dressings.

The most common abscess is the psoas abscess, and the great point in its treatment is to aspirate it while in the pelvis, before it enters the thigh. If it is allowed to do so, it worms its way among the fascial compartments, and becomes loculated and very difficult to empty.

In the treatment of abscesses it is very important to keep them empty by repeated aspiration. In this way the tendency to sloughing of the superficial tissues can often be avoided.

(2) Injection of the Abscess with modifying fluids. A considerable percentage of abscesses is found to heal with injection and subsequent withdrawal of a 10 per cent iodoform in glycerin emulsion. Up to from 50 to 100 grams of the solution may be injected. With this treatment the contents of the abscess change quickly from a thick pus to one of more liquid and mucous character.

Careful dosage is necessary in case of iodoform intoxication.

(44)

Calot uses the formula: sterilised oil 70 gms., ether 30 gms., creosote 6 gms., iodoform 10 gms., injected in doses of 2 to 12 gms., according to the age of the

patient. The number of aspirations and injections are from 10 to 12; they are continued until the fluid withdrawn is serous in character.

Another type of modifying fluid introduced by Calot is: naphthol camphor 2 gms., glycerin 12 gms. To be shaken vigorously for $1\frac{1}{2}$ minutes and injected immediately. The use of modifying fluids has been given up in Millport as unnecessary; also these fluids often act as irritants to the inner lining of the abscess cavity, and are apt to cause inflammation or even sloughing of the superficial surface.

In those cases referred to previously where the abscess was sterile, it is usually found that one aspiration is sufficient to empty permanently the abscess cavity.

(3) Operative Treatment.

(a) The retropharyngeal abscess.

If the abscess is obstructing breathing and swallowing, it demands prompt evacuation. In case of emergency this may be accomplished by an incision in the midline of the posterior pharyngeal wall. The routine evacuation, however, should be made at the side of the neck, entering through the fascia and following the anterior surface of the scaleni. One finds the abscess just behind the prevertebral fascia, which is bulging forward.

(40)

Calot punctures immediately in front of the transverse process of the axis or the 3rd vertebra on a vertical

line passing through the external auditory meatus, which line corresponds to the line of the transverse processes of these vertebrae. He pushes the needle, resting against the anterior face of the vertebra, in such wise that he arrives straight on the collection of pus, in which he makes the necessary puncture followed by injection.

(b) Cervical Region Abscesses point to the lateral triangle of the neck and can be approached by the same route.

(c) Upper thoracic region abscesses may cause pressure upon trachea and bronchi, and demand speedy evacuation. The route already described is suitable.

(d) The retromediastinal Abscess. This may become dangerous by pressure against the contents of the retromediastinal space, by perforation into pleura or pericardium, or by invading the spinal canal and causing a most persistent paraplegia.

If the abscess is accessible enough and if its contents are sufficiently liquid, it can be treated by puncture or aspiration. An antero-posterior and lateral X-ray are taken before operation, after ingestion of bismuth, so that the outline of the oesophagus is defined, and the space between it and the spinal column denotes the situation of the abscess. Then a trocar not less than 9 cm. long is introduced through the intercostal space into the mediastinum, giving it a slanting direction toward

the midline, and letting it follow closely the contour of the vertebral body. It is held close to the upper border of the ribs so as to avoid injury to the intercostal nerve and vein. Pus is usually found at a depth of 6-9 cms. (45)

Prevertebral abscesses of the lumbar spine are not so well adapted to puncture because they gravitate downward toward Poupert's ligament.

In many instances the symptoms of mediastinal abscess are so threatening that the indication arises for more radical procedures. The operation best applicable to this condition is costotransversectomy.

This operation was first performed for tuberculosis of the spine by Menard (46) in 1895. It is superior to simple aspiration because it gives a much better outlet to the thick and creamy pus. It is a very effective means of combating the paraplegia caused by the retromediastinal abscess, but it often causes a sinus.

The operation consists in the resection of the lateral ends of the transverse processes with the attached ends of the ribs. One first makes the approach by stripping the laminae and neural arches as is done in the method of Hibbs; then one resects the lateral half of the transverse process, and follows it by resection of the head and neck of the rib. The operation requires a good deal of care, as the lungs and pleura might easily be injured.

(e) Transperitoneal Drainage.

An abscess from the lumbar area accumulates in front of the sacrum or 5th lumbar vertebra. The closed retroperitoneal abscess is treated conservatively. If perforation occurs and a sinus is established, the subsequent pyogenic and septic changes are responsible for a high mortality, and energetic measures are required for complete evacuation of the abscess. The abscess can be reached by incision along the erector spinae mass exposing the quadratus lumborum, and proceeding to the anterior surface of this muscle. The abscess can be felt by the finger passed under the transverse process toward the body, and wide drainage is established.

(f) Sacral abscess and trans-sacral drainage.

In cases of presacral abscess the drainage must often be established through the sacrum by resection of the sacro-iliac articulation, including portions of the os ilei and the sacrum.

Fistula formation.

(40)

Calot recommends that fistulae should be injected with creosote 5 gms: iodoform 10 gms: ether 25 gms: olive oil 75 gms:, or a paste containing camphorated phenol, camphorated naphthol, creosote and guaiacol \overline{aa} 69 gms: spermaceti and lanoline \overline{aa} 50 gms, provided that they are not septic (that is, no fever or albuminuria).

If the fistula is septic, he advises that there should be no injections, but that it should be treated constitutionally. In this connection the use of lipiodol injected into the sinus to track the site of the lesion by subsequent radiograms at intervals is worth noting.

IV. Surgical Treatment.

1. Operative Treatment of Compression Paralysis: Spinal Decompression.

Laminectomy is indicated in tuberculosis of the spine when conservative treatment fails to relieve the compression paraplegia. If an abscess in the retromediastinal space can be assumed to be responsible for the compression symptoms, then the above-mentioned methods of drainage of the abscess are given first consideration. In the majority of cases paraplegia recovers under prolonged recumbency and traction; it is, therefore, only a small minority of cases in which decompression by laminectomy becomes necessary.

As a rule the indication for this operation is made only after a long and patient attempt to relieve compression symptoms by conservative means. Occasionally, however, one must act quickly; for instance, in the rare cases in which the spastic character of the paralysis suddenly changes to the flaccid type, or in cases in which there

is evidence of sudden collapse with bony pressure against the spinal cord. An indication also exists in the rare cases of exuberant new bone formation at the seat of repair and subsequent bony pressure upon the spinal cord, also in cases of definite bony fusion of the spine, not yielding promptly to traction and recumbency.

The patient is placed in the prone position with sandbags under the pelvis, upper part of the chest and the forehead. The site of the lesion having been localised, a free incision is made to expose the spinous processes of at least five or six vertebrae. With a strong bladed knife the muscles are separated from the spinous processes and laminae, first on one side and then on the other, the bleeding being arrested by forceps and gauze packing. The muscular masses being held aside with broad retractors, the interspinous ligaments are then divided with scissors, and the spines snipped off at their bases from above downwards with bone-pliers. The laminae to be divided are then cleared with a periosteum separator or chisel as far as their junctions with the pedicles, the ligamenta flava divided with scissors and a suitable saw applied. If there is difficulty in dividing the bone with the saw alone, the section may be completed with bone-pliers, all bone being removed as far laterally as the articular processes. Close attention must be paid

to the first appearance of the dura and great care taken not to injure it. The cavity is packed with hot sponges in order to control completely the oozing from the bone. If decompression alone is contemplated, and this is most frequently the case in Pott's disease, there is no need of opening the dura. (48)

Statistics on the results of laminectomy vary widely. The largest series, reported by Denk, (47) gave discouraging results, and the majority of his patients ultimately succumbed. Steindler thinks that to give results laminectomy, even though it is the last resort, must be undertaken at the right time before degenerative changes have taken place.

(49)
Girdlestone has recently advocated early decompression for Pott's paraplegia in adults. The decompression may take the form of laminectomy, costotransversectomy, or both, but, whatever the method of decompression, he regards stabilisation by bone-grafting of the diseased part of the spine as an essential complement. He has long been convinced of the neurological advantage of early operation, and bone grafting has removed the drawback of laminectomy that it produced by itself a further structural defect in a vertebral column already undermined by caries. He believes that decompression is indicated, both because some cases do not clear up at all without operation, and also because in many others there is a

long period of compression which is dangerous and harmful to the cord. Also this long-continued paraplegia is harmful and most distressing to the patient, and this at a time when restoration of his lost vitality is an urgent need.

In his experience paraplegia generally comes on in the first few months of the disease, and in these cases the pressure is almost always from abscess, granulation tissue, debris, etc. in front of the theca. If the paraplegia advances quickly, or if it progressively advances during immobilisation, he operates to relieve compression by costotransversectomy or laminectomy or both. In addition he does a twin graft fixation. After laminectomy these grafts bridge the opening and more than counteract the local loss of laminae and spines. In effect a mobile chain of laminae is replaced by a pair of strong grafts, which hold the diseased area of spine much better than an external splint.

He has had twelve cases of Pott's paraplegia during the last ten years on whom he has operated for relief of pressure on the cord.

There have been two deaths, both in late and clearly almost hopeless cases. One is too recent to allow of a progress report. Of the other nine, recovery, partial in four, complete in five, has occurred. It is noteworthy as regards two of the complete recovery cases that the

paraplegia had occurred late on in the second year of the disease. Further, of the four partials, two are still improving progressively and seem likely to recover completely.

2. Fusion operations.

It is extremely difficult to assess what place to give to fusion operations in the treatment of Pott's disease after reading a succession of articles by disciples both of the conservative and surgical schools.

One can only conclude that their enthusiasm for their individual points of view has led them to claim somewhat exaggerated successes for their respective treatments and to minimise the good results obtained by their opponents. As usual, the real position lies somewhere between the two extremes.

Calot, for instance, an eminent member of the con-
(40)
tinental conservative school, tells us that he has given up operative treatment entirely, though he claims to have performed the first osteosynthesis in 1897, because conservative treatment has yielded him, on the whole, more certain, more numerous and more satisfactory recoveries without taking any longer. This conservative treatment consists of rest, with plaster or celluloid jackets with a dorsal opening for the cotton wool compression of the hump.

This is what he describes as the balance-sheet of osteosynthesis:

- (a) It is powerless to prevent aggravation of the hump.
- (b) It does not enable us to gain a single day in the duration of the treatment.
- (c) It is of no value in abscess and paralysis.
- (d) The death rate is twice as great as with the orthopaedic treatment alone.

He writes very scathingly that to believe, or to get people to believe, that it is possible, as Albee has written, "to cure in seven weeks a case of Pott's disease operated on during its active phase" and to cure "immediately" a big iliac abscess by simply placing on the spinous processes a chunk of bone - that would, indeed, be the magic wand. But this illusive miracle has been shown to be a delusion, and a snare. Everyone who thinks that victory can be achieved in Pott's disease by a brilliant operation lasting half an hour makes a bad mistake. The reality, alas, is much less brilliant. The reality is that Pott's disease demands the minutest attention, commonplace though it be, measures that have to be repeated in most instances week by week for two, three or four years; victory is at this price, this victory being the maximum at present available with a minimum of failures and deaths.

(50)

Albee on the other hand says that the plaster cast must be judged according to the general principles of

splinting. Since both thorax and abdomen normally change their dimensions constantly, the cast cannot be fitted closely enough to obtain immobility, and this cardinal principle of splinting must be sacrificed. It cannot be expected that any form of external splinting will immobilise a series of short bones of irregular contour to which are attached muscles of respiration and the voluntary muscles which move head and limbs. The cast seriously restricts the movements of thorax and abdomen and interferes with the oxidation and nutrition on which so much depends in the treatment of any form of tuberculosis. If there is an apical focus, the case tends to aggravate it by constricting the lower lobes and leaving the upper relatively free. The Bradford frame and block have their own disadvantages, the most important of which is the protracted inactivity of the patient. There is no possibility of grading physical activity as the disease abates, and this valuable therapeutic measure cannot be resorted to until nature, under such a handicap, has gone a long and tedious way toward curing the disease.

He condemns conservative methods of treatment as the application of measures of doubtful efficacy under circumstances more or less inimical to the general health of the patient.

He states that no disease varies in virulence and in response to expectant treatment so much as tuberculosis.

It is unfortunately impossible in the incipient stages to say whether the course will be mild and favourable or progressive, destructive and fatal; whether conservative methods will have any effect, and if so, how long they will require. He has always felt the profoundest regret in operating in these unfortunate protracted cases, that the operation had not been undertaken long before and the patient spared years of invalidism. If one could foresee, one would operate in the great majority of cases. Since one cannot foresee, there is only one attitude to adopt toward a given case, and that is to consider that it may be unfavourable and to operate in every case, at any age, provided the surgical risk is good.

(15)
Girdlestone states that in the past operation has too often been thought of as if it did in itself definitely provide a short cut to the cure of Pott's disease. Wholly extravagant claims have been made on behalf of this new means of treatment, and altogether too much reliance has been placed upon it. Cases have been treated by operation without proper splintage, without open-air methods and without adequate rest or sufficient time. This mistaken view of the scope of operative fixation has led to many failures and much disappointment. As a result the operation has not been seen in true perspective. It is highly esteemed by those who use it as "part of the conservative treatment of Pott's disease".

There can be no short cuts to cure in this disease. End-results teach us that in serious bone and joint tuberculosis short cuts lead altogether in the wrong direction. In the spinal lesion the gradual processes which end in cicatrisation take their inevitable time, and this lesion is only part of an invasion of the patient's body by the tubercle bacillus. Every influence to restore and raise his vitality must be applied. His needs are twofold, and before treatment is complete (1) his general health and powers of reaction must have been raised superior to the destructive activities of the tubercle bacillus in his spine and elsewhere; (2) the spinal lesion must be healed, and sound structural stability of the damaged part re-established. Operative spinal fixation helps in the splintage of the spine during the disease, and adds to its stability afterwards, but it cannot replace the established principles of treatment. * Barnett (52) says that the pendulum is now swinging the other way, from purely conservative methods to conservatism with selective operations superadded. The French have a happy phrase for this: they call such a surgeon an "Interventionist". This increasing vogue for operative interference is due entirely to the relative failure of conservative methods in one of several particulars. Conservatism, at the best, is a prolonged ordeal for the patient, extending over one to five years, an economic factor not to be despised in

* New paragraph.

these penurious days. Anything then, which will shorten treatment, while giving equal or better results, is to be welcomed.

Apart from the treatment of complications such as compression, operation for spinal caries should be limited to late and selected cases. Wide fixation is best done in adults only and for large angular curves where collapse is complete. On the other hand, where collapse is limited practically to two vertebrae, their fusion by graft is well worth doing to prevent any tearing of scar tissue due to a fall or sudden strain.

Equally good results are claimed for purely conservative treatment, especially abroad, but Barnett stresses the much shorter period of treatment with him, and the proved fact that his patients are functionally good, not only in hospital, but in their own homes.* Fraser ⁽⁴⁾ says that there is much to be said for conservative treatment, and at the present time it is the popular line of treatment, particularly where children are concerned. It has disadvantages, however, as its strongest supporters will agree, and the following are evident:

- (a) The control of the treatment is difficult.
- (b) Speaking in comparative terms, a great length of time is demanded.
- (c) Inflexion is almost impossible to prevent, and therefore some degree of kyphosis is inevitable.
- (d) The vertebral bodies do not readily form new bone, and in the absence of direct stimulus

* New paragraph

the periosteum is unlikely to produce it; the process of natural cure is therefore a fibrous union with the constant liability to relapse.

For these reasons he has always been dissatisfied with the attitude of pure conservatism. He feels that, in view of the peculiarities of the situation in respect of new bone formation and the risks which must necessarily attend inflexion, the successful treatment will be found in a method by which an artificial ankylosis of the spine is induced.

Fusion operations in spinal tuberculosis are only palliative. They do not touch the seat of the disease, and cannot claim to have a direct influence on the course of tuberculous changes within the vertebral bodies. They do claim, however, to affect a complete, reliable, and permanent immobilisation of the spine by internal splinting.

Steindler gives the following indications for fusion operations:

(1) In children, exceptionally, namely in high localisation (cervico-dorsal or high dorsal), and in the presence of compression symptoms not responding to recumbency, but not requiring laminectomy.

The reasons for restricting the indications in children are (a) the tendency to natural bony fusion of the spine is much greater in children than in adults, and

(b) recumbency is the safest treatment in tuberculosis of the spine, and is the more appropriate in children since the advantages of sunlight and fresh air treatment, as well as that of education and recreation can be combined with recumbent treatment.

(2) In adults, more generally, especially if the disease is located in the lower dorsal or lumbar spine. Here, it may almost be made the rule, subject only to restrictions pertaining to the general health of the patient, especially to the condition of the lungs, or to other complications which might increase the operative risk.

As to the stage of disease in which operation should best be performed, whether early or late, the majority of opinion inclines toward early operation; there are, however, objections raised by some against operating before bony repair is definitely established.

Technique.

Only the operations in most general use will be briefly described.

(1) Albee's Method.

It is recognised that all these operations have their origin in the method of Albee or of Hibbs. Both aim at fusing the posterior parts of the affected vertebrae, together with two or three vertebrae above and below them. In Albee's method this is done by splitting the spinous processes and placing in the groove so formed a graft

taken from the shaft of the tibia. If deformity is severe, flexion of the graft is obtained either by shaping it or by making saw cuts parallel to its long axis so that it can be bent - the so-called "bundle of reeds". (53)

One modification of Albee's technique is the use of beef-bone instead of the living graft.

(2) Hibbs' Method.

This comprises fusing the laminae of the corresponding area into one solid mass. To do this, the ligamentum subflavum and all soft tissue attached to the laminae must be dissected away, and the intervertebral articulations destroyed. The bony bridges are then made by turning down small bone flaps from the laminae, and finally the spinal processes, previously broken down, are placed so as to assist in forming the bridge.

Both of these operations are very successful when performed by their originators, but when attempted by others less experienced, both present certain difficulties.

The degree of development of the spinous processes varies considerably. Sometimes their extreme flexibility makes it hard to split them, and difficulty arises in gauging the depth of the groove, which may easily be either too deep or too shallow. Again, when a lateral curve is associated with the usual kyphosis, the spinous processes are not in line, and this may call for the very difficult task of cutting a graft curved in two planes. Further,

there is the risk that the use of a mallet and chisel so near the infected part may cause the infection to light up. Another danger is that the graft, being relatively small, may later be fractured, particularly as a result of torsion of the body.

Hibbs' operation has the advantage over Albee's that the fusion is more general and the method can be used in all degrees of deformity; in addition, the removal of the prominent spinous processes improves the appearance, and diminishes the risk of pressure both during the early post-operative stages and later, when a spinal support is applied. It has, however, some disadvantages, chief amongst which are the meticulous care required, the time necessary to perform it, and the consequent increased risk of post-operative shock. The operation is more difficult to do in the lumbar region than in the dorsal. In the latter, the laminae overlap to a greater degree; there is consequently a smaller gap to bridge, and also they are more superficially placed. For these reasons, it is agreed that there are difficulties in both the operations and it is as a consequence of this that various modifications have been made.

(3) Hey Groves has used a method in which two grafts are placed, one on each side of the spinous processes, and sutured or bolted together. By this means a double thick-

ness of graft is obtained and the strength of the spinous process is not impaired.

(55)

(4) Gibson of Winnipeg uses a method in which a solid graft with two clothes-peg ends is cut from the tibia, the spinous processes of the affected vertebrae are detached, and the sides of the spinous processes of the two vertebrae above and below are cleared and made raw. The graft is then applied over the raw surface of the bases of the detached processes, while the two limbs of the clothes-peg ends lie on each side of the spinous processes above and below.

(5) In a third method grafts from the tibia are placed in the vertebral grooves of the laminae. This operation consists in stripping, with a large chisel, the periosteum and muscles from the sides of the spinous processes and from the laminae, and freshening the surfaces so exposed. When this has been done, grafts from the tibia, shaped or straight as need be, are placed in the grooves. The grafts are then in position, held by suturing the muscles over them after removing the prominent spinous processes.

(54)

This method has been strongly advocated by Wheeler who, however, puts the graft on one side only.

It is mechanically sound, combining, as it does, the advantages of Hibbs' and Albee's methods. It is easy to perform, therefore causing less post-operative shock,

and it is adaptable to all types of deformity in the dorsal and lumbar regions.

During the past twelve months Malkin has used this method in eight cases of various types. While it is yet too early to speak of final results, in all cases he has found the method uniformly satisfactory.

(4)

Fraser favours Hibbs' method, but thinks that the ideal posterior fixation operation has yet to be evolved.

The After-treatment of Fusion Operation of the Spine.

The patient is kept in bed on a posterior spine brace or a bivalved plaster bed for a period of eight weeks. The fusion is then sufficiently complete to permit the patient to sit up in a body cast, and after six months he is allowed to be up and about, provided there are no features in the condition of the tuberculous spine which demand further prolongation of recumbency. At this time the cast may be removed and a back brace worn for a period of not less than one or probably two years after operation.

Statistics on Operative Fusion.

The operative mortality is small. In Steindler's series of 144 cases operated on by Hibbs' method, there was no immediate post-operative death. His late mortality was 15%, which is somewhat better than the mortality in all kinds of cases under conservative treatment.

Fusion by Hibbs' operation can be accomplished in

practically all types of cases. This has been confirmed by post mortem examinations.

To Sum Up.

(1) The fusion operation provides absolute immobilisation of the spine by transforming the posterior column into a solid and unyielding sheet of bone. This is the only effect of the operation of which we are reasonably certain.

(2) Though it does not prevent or influence the formation of abscesses, or the occurrence of spinal compression, this absolute internal fixation makes the collapse of the spine and the reinfection of opposing bone surfaces much less likely. Accordingly the final course of the disease is favourably influenced by the operation.

(3) In children, the indication must be drawn much more restrictedly than in adults, but in the latter, especially if the seat of the disease is the lower dorsal or the lumbar spine, the fusion operation is of distinct benefit.

(4) There can be no objection to operation in early cases so long as it is realised that they depend on recumbency, regardless of operation, until the adequate stage of repair is reached. In later cases, either the destructive process must have come to a halt, so that the graft functions merely as a weight-bearing support and not as a brace against forward bending, or else operation must be combined with recumbent treatment until this point is reached.

(5) In certain cases with abnormal mobility within the region of the gibbus, the operative measures are indicated to obliterate this motion.

(6) Fusion operation is also indicated in cases with involvement of several vertebrae with lack of functional repair, incomplete callus formation, instability of the spine, and often with neuralgic symptoms; also the cases with impingement symptoms or secondary strain, principally in the lumbar or lumbo-sacral regions.

-----oOo-----

C A S E S.CASE I.

This case is included because of the fact that it showed a lesion of the spine of a vertebra without any apparent involvement of the body.

Alex. Wallace. Age 11. Admitted 27/5/32.

Family History:-

One brother aged 14 admitted to Millport on 17/2/32 with tuberculosis of the right hip joint and discharged on 2/12/32 with good functional result. Otherwise nothing of note.

Previous Illnesses:-

Measles, chickenpox, whooping cough. No scarlet or diphtheria.

Feeding: breast.

History of Present Illness:-

About two months ago a swelling came on the back of the neck but there was no pain. He was taken to Dr. Campbell who has cut it on two occasions. It has not healed and there is still some discharge. He complains of pain in the shoulder and can hardly move the arm. This pain first came one month ago and has been getting worse.

Present Condition:- General condition fairly good.

Circulation:- Heart sounds pure.

Respiration:- No lung disease.

Alimentary Tract:- Teeth good. Abdomen normal.

Nervous System:- Normal.

Genito-urinary System:- No albumen.

Lymphatic Glands:- None enlarged.

Skin:- Healthy. Skeleton:- Nothing apart from lesion.

Von Pirquet Reaction:- Positive.

Lesion:-

The head is held stiffly erect and the movements of the cervical spine are definitely restricted.

He complains of loss of power in both arms and his grip is poor. A sinus following incision of an abscess is present in the middle line of the neck behind at the level of the fourth and fifth cervical spines. A small amount of discharge is present and appears to be tuberculous pus.

Radiogram:- A.P. view shows nothing definite but the lateral view reveals considerable destruction of bone in the spine of the fourth cervical vertebra.

Case Notes:-

20/6/32. He is now in a shell which includes head and pelvis and appears to be comfortable.

1/7/32. He is comfortable in his shell and there is improvement in the grip of both hands.

18/7/32. General condition has improved and discharge is now slight.

1/8/32. There is much less discharge and general condition is still improving.

15/8/32. Only a spot of discharge.

29/8/32. Sinus scraped and samples sent to Griffith. Found to be bovine in type. Temperature has been elevated for two days.

19/10/32. Original sinus has healed but another has formed just below it and this is still discharging.

14/11/32. He has had a carbuncle to the left of the lower sinus.

11/12/32. Carbuncle rather indolent and not healing. Very little discharge.

25/1/33. Superficial lesions have healed. Radiogram shows that disease has spread from the affected spine to the body of the vertebra. There is also a lesion of the spine of the next lower vertebra.

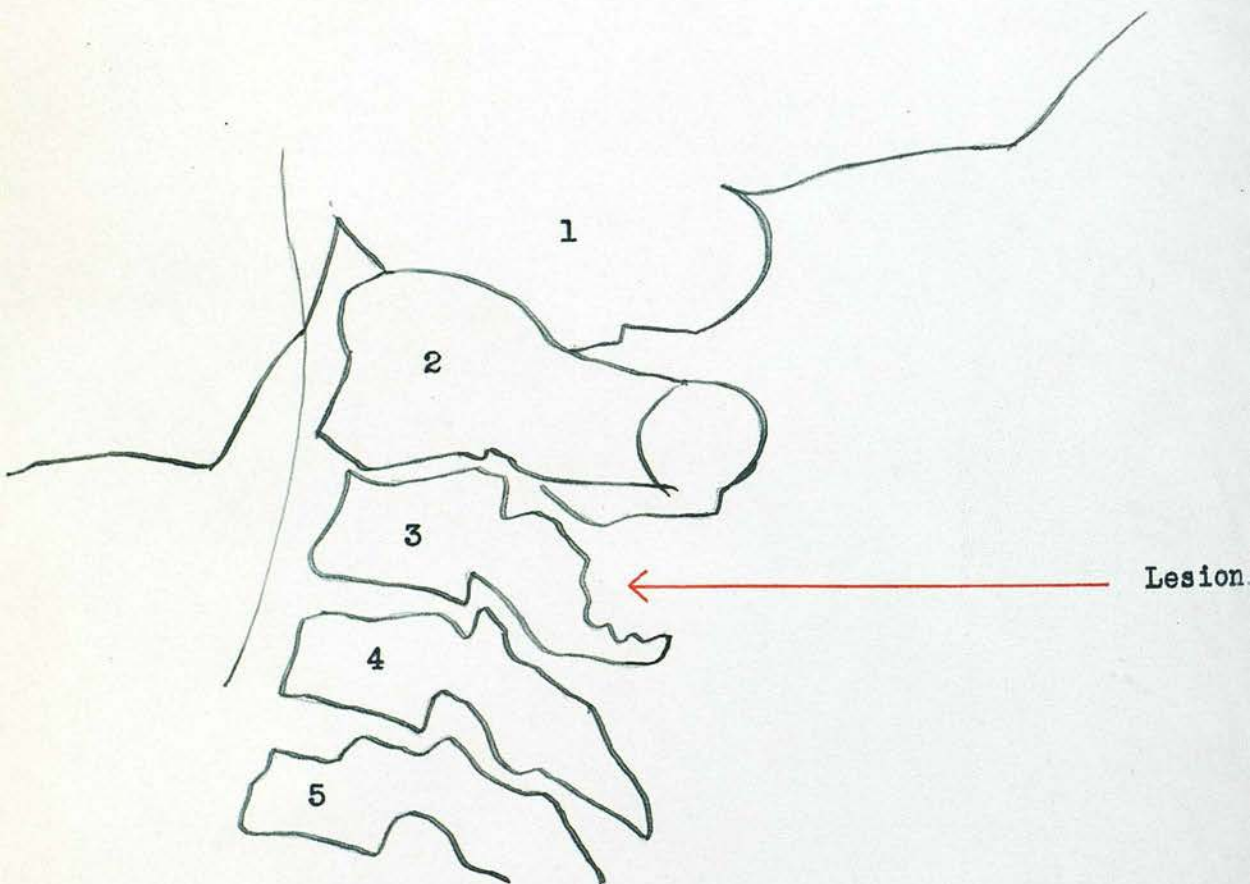
20/2/33. He has developed paraplegia with retention of urine and is becoming oedematous. Hands and feet are swollen. He has been fitted with a head band and suspended on a tip-up bed.

There is no improvement so far and the prognosis is bad.

22/2/33. He died today rather suddenly at 4.30 p.m.

Alexander Wallace.

The opposite radiogram has not printed well but it shows a lesion of the spine of the third cervical vertebra corresponding in position with the sinus which existed when he was admitted to hospital.



The above is tracing from a negative which would also suffer in reproduction.

St. Andrew's House, Mill
2. 6. 22
1024/1025
18. 3. 22



CASE II.

This case of upper dorsal disease is a very interesting one, showing the development of a paraplegia after 1 year and 10 months recumbency, when the child had reached the stage of the ventral position and everything seemed to indicate that the lesion had healed. By means of lipiodol, injected by cistern puncture, it was demonstrated that the blockage of the canal was not complete, and that there was no indication for surgical treatment. The case also shows a prevertebral abscess which tracked upwards and pointed above the upper border of the trapezius. The paraplegia lasted for two years and recovery was only partial.

Robert Allan. Aged 3. Admitted 20/7/28.

Family History:-

Nothing of note.

Home conditions:- Three rooms.

Personal History:-

Feeding - Breast fed.

Previous Illnesses:-

Measles at age of $1\frac{1}{2}$ years left him thin and wasted. No other infectious diseases followed, but he has never picked up since.

History of Present Illness:-

The mother has noticed drawing up of shoulders ever since the above illness. During last winter he had a swelling behind the right ear, and an abscess formed and was opened. It discharged for two or three weeks. Since

February he has had diarrhoea and swollen abdomen. He has sweated at night and has a very poor appetite.

Two months ago he was X-rayed when a diagnosis of cervical caries was made. Radiograms, however, sent with the patient show caries of 4th and 5th dorsal, with pre-vertebral abscess.

Circulation:- Heart sounds normal.

Respiration:- There are a few rales at the right base.

Alimentary Tract:- His teeth are unduly carious for his age. He seems to have nasopharyngeal obstruction.

Abdomen is unduly full but no free fluid can be detected. There is no palpable evidence of tabes mesenterica.

Urinary System:- Nil.

Nervous System:- Nil.

Lymphatic glands:- None palpable, but there is a scar behind the left ear which I think is due to post-auricular tuberculous adenitis.

Skin:- Impetigo of face, probably nasal in origin.

Skeleton:- Nil. except as noted under lesion.

Lesion:-

There is a sharp gibbus formed by protrusion of the spine of the 5th dorsal vertebra. Radiogram shows that the bodies of the 4th and 5th dorsal vertebrae are diseased and collapsed upon one another. There is a large prevertebral abscess which joins up with the heart shadow.

Case Notes:-

4/9/28. This boy has been kept in a crib up to date fixed in the dorsal position with straps. His abdomen has at times become full. Impetigo was marked on the face for two weeks. He is going on well.

17/9/28. On board.

2/11/28. This boy has reacted well to outdoor treatment. He has gained a good deal of weight, and there are no abdominal symptoms. Skin around left ear is still troublesome and the old mastoid wound is open and dis-

charging. Local condition is unchanged.

12/11/28. General condition much improved. The ear is still giving trouble.

26/11/28. Ear has almost healed.

10/12/28. Going on well. Ear healed.

24/12/28. Marked general improvement.

7/1/29. There is undue prominence about the level of the 12th dorsal vertebra.

14/1/29. The general condition of this boy is very good. Radiogram, however, shows that since his admission the 6th dorsal vertebra has become involved. The abscess outline is not so clear. The bodies now affected are the 4th 5th and 6th.

8/4/29. He is going on well. He is a pigmenter.

1/7/29. Progress has been maintained in this case. There has been no further destruction of bone, and abdominal symptoms are absent.

1/10/29. This boy has continued to make good progress during the quarter. Abdominal signs remain absent. Radiogram of 2/9/29 shows no advance of the disease and an apparent commencement of inspissation of the abscess.

1/1/30. The general condition of this boy remains excellent. We have now no trouble with the abdomen and the condition of his spine is satisfactory.

1/4/30. The general condition of this boy remained excellent during the quarter. I think the disease is approaching the stage of arrest.

8/4/30. X-rayed yeaterday. Lesion is cicatrising. Clinically he is doing well. Celluloid jacket to be made.

14/4/30. Now in ventral position.

12/5/30. Has gone on well.

19/5/30. Today this boy complains of pain in the legs and he has spasm. Some loss of sensation in legs and abdomen.

26/5/30. He has a definite paraplegia. Skin is good and there is no incontinence.

9/6/30. In statu quo. Radiogram shows no change Skin sound.

16/6/30. There is no improvement.

23/6/30. Skin remains sound. No voluntary movement of legs. Spasm remains.

7/7/30. Skin sound. Slight voluntary movement noticed today.

4/8/30. Skin remains sound but there is little change to be seen.

15/9/30. Slight voluntary movement on occasion.

7/10/30. Seen by Mr. Rankin who suggests that lipiodol should be injected into the cistern and the result of the subsequent radiograms taken into consideration before any active interference be undertaken.

13/10/30. Lipiodol (3 C.C.) was injected on 8/10/30. Films show the result. A few days afterwards lipiodol is seen down the canal past the obstruction. He has had several attacks of abdominal and praecordial pain with dyspnoea. The blockage of the canal was not complete, and eventually most of the lipiodol found its way into the lumbar region. The conclusion drawn from this experiment is that the paraplegia is not due to abscess or bony pressure, but probably due to pachymeningitis of the cord, or a tuberculous myelitis. If such is the case, operation would be useless, and consideration of it has meantime been abandoned.

1/4/31. His general condition remains good, but there has been no improvement noticeable in the paraplegia. Very slight voluntary movement was noted in the right foot on 16/3/31 but apart from this the paraplegia has remained complete. There is no incontinence.

The prognosis remains grave but operative measures are not indicated.

4/5/31. Nocturnal incontinence reported.

1/7/31. General condition remains good.

On 14/6/31 return of some voluntary movement was noted

for the first time. On left he can move toes and ankles, but on right side voluntary movements of toes, ankle, knee and thigh muscles are now present. The prognosis is still rather doubtful but brighter on the whole.

13/7/31. Last week a swelling was noted above the upper border of the trapezius, close to the spinal column. Aspiration yielded 5 c.c of thick pus. On 12/7/31 he had good voluntary movement of feet, legs and thighs on both sides. The abscess had evidently tracked from the prevertebral abscess.

20/7/31. Voluntary movement still improving slowly.

10/8/31. There is definitely less voluntary movement of legs. Aspiration failed to produce pus from abscess.

17/8/31. Last week the control of legs varied. Yesterday it was at its optimum.

24/8/31. 20 c.c pus aspirated, thinner in character. No marked change in the amount of control of the legs.

7/9/31. Another 15 c.c with drawn. The wall of the abscess is very thick.

14/9/31. Aspirated again last week.

20/10/31. Voluntary movement persists, but there is no great change during the past few weeks. His legs are still spastic and the reflexes are brisk.

17/11/31. There is little change in the external size of the abscess. He is afebrile and in good general condition. Legs can be moved freely and spasticity is much less marked. Compared with a month ago he is much improved.

30/11/31. He is in the ventral position.

7/12/31. Apparently doing well.

18/1/32. There has been no increase in voluntary movement of the legs during the past few weeks.

8/2/32. The general condition remains good. He has regained a degree of voluntary control of the legs but there is still much spasticity of the adductors. The abscess is still palpable, but has not required aspiration for over two months. Latterly he has been in the ventral

position for a short time daily. He has still a long way to go before he can start getting up.

1/4/32. Still fixed on spinal board. The improvement in the condition of the legs has not been continued. His general condition is still good. The result will probably be a bad one.

1/7/32. Improvement in the control of the legs has again taken place and he is allowed to crawl about but is still quite unable to stand. The abscess has fibrosed and is palpable as a hard nodule. His general condition has remained good, and the outlook is not so gloomy,

1/10/32. His progress during the quarter has been of necessity slow, but he can now stand with some support. His general condition remains good and the voluntary control of the leg muscles slowly improves.

1/1/33. He has made good progress during the quarter. He is now able to walk with support from surrounding objects and can crawl about on the grass.

Summary:- 3/2/33.

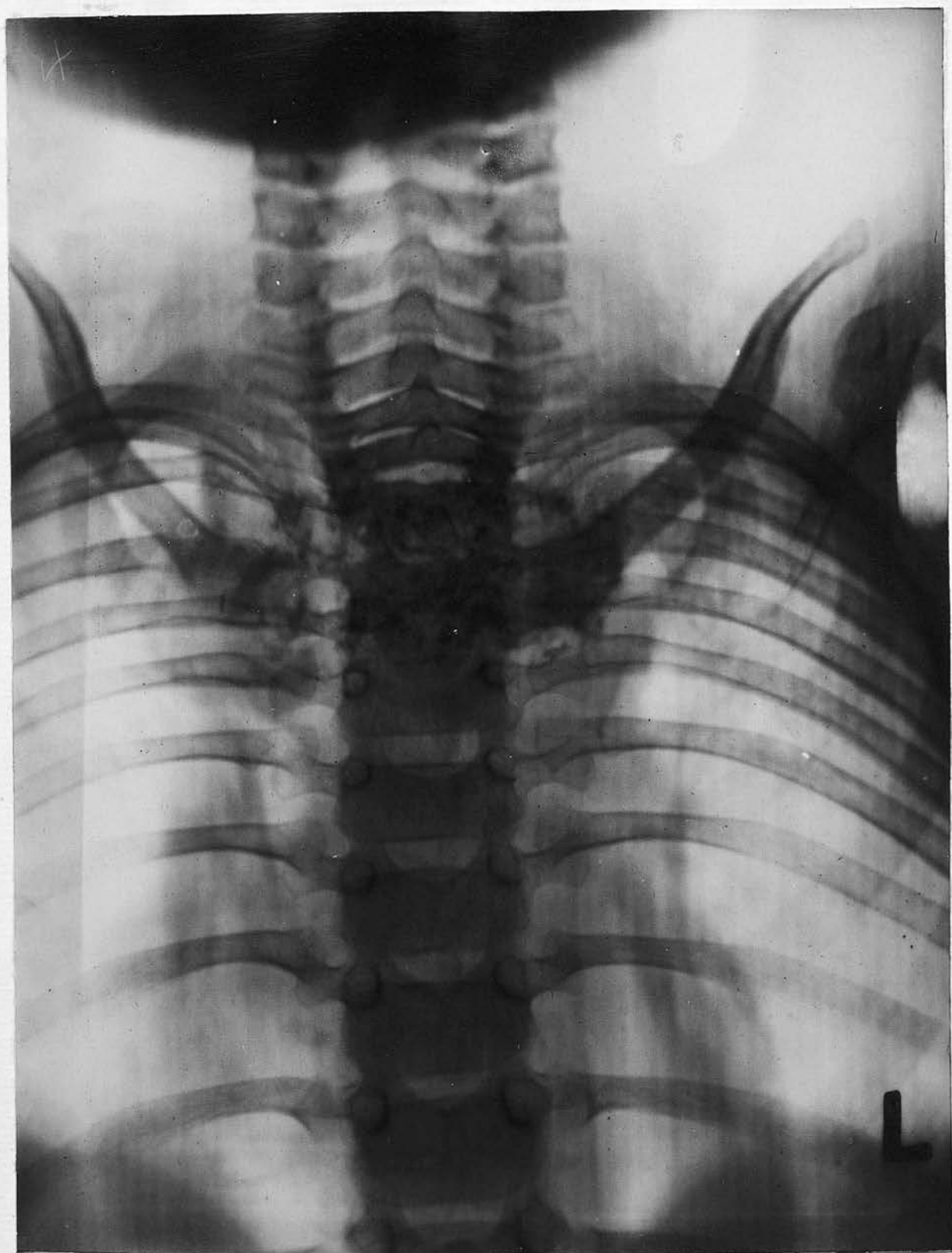
This child was admitted suffering from tuberculosis of the 5th dorsal vertebra, with prevertebral abscess. He had previously suffered from abdominal and glandular tuberculosis, and a mastoid operation had been carried out on the left side. He developed complete paralysis of legs after being under treatment for one year and eight months and the condition persisted for two years.

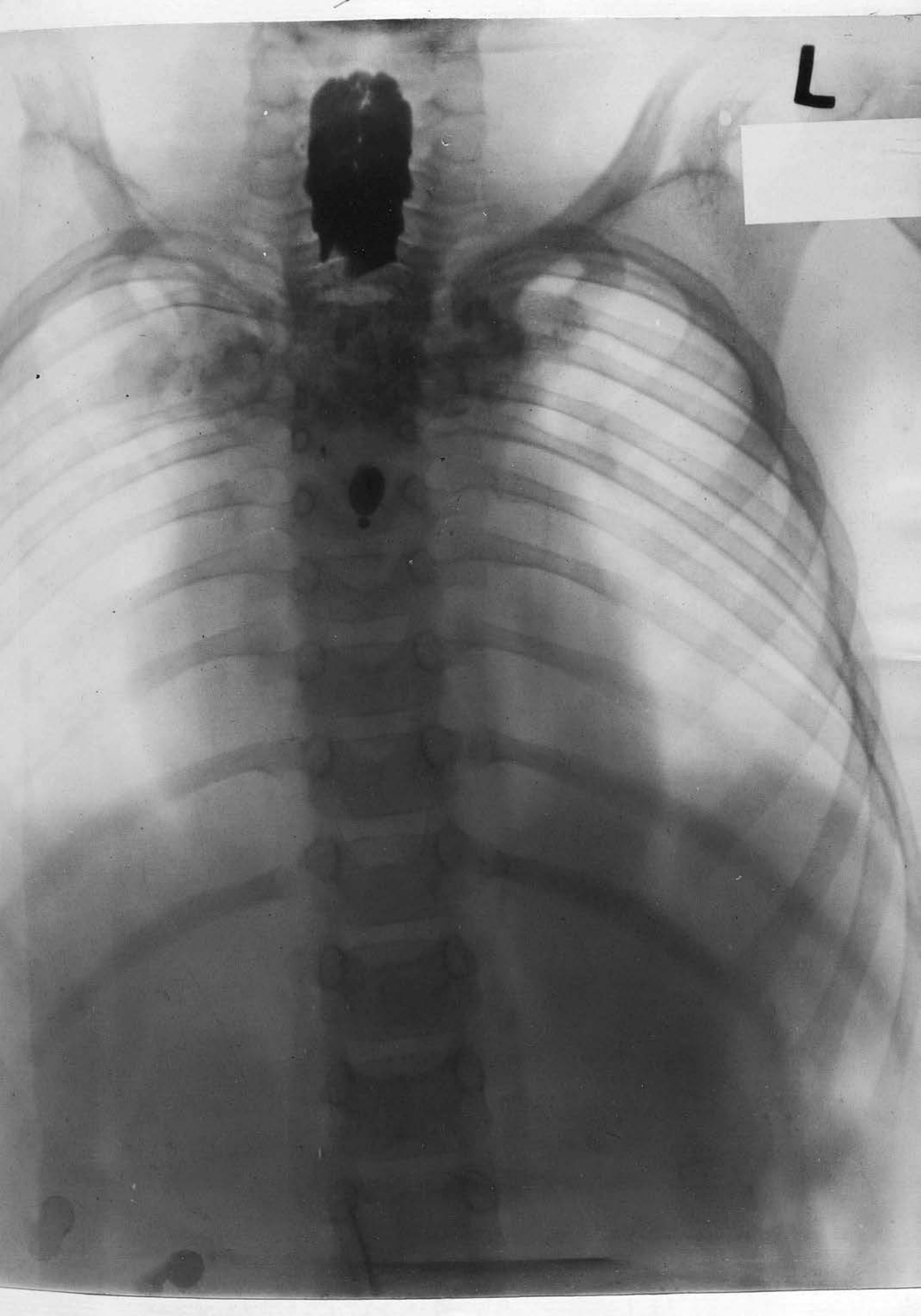
The child can now stand with ease and walk with support gained from surrounding objects. He has been transferred to Largs, and it is recommended that the use of crutches be not allowed.

Robert Allan.

- (1) Antero-posterior radiogram showing inspissated abscess after the boy had been recumbent for over two years, and when the ventral position was about to be assumed. There were then no signs of pressure on the cord.
- (2) Lipiodol injected into the cistern. 20 hours afterwards only one spot had passed the lesion.
- (3) Four months afterwards most of the lipiodol has passed the lesion. Signs of pressure were then beginning to pass off.

I





III



CASE III.

This was a case of lower dorsal disease, with a large mediastinal abscess which caused interference with the structures of the mediastinum and terminated fatally.

Emily Turnbull. Aged 4. Admitted 22/3/27.

Family History:-

Father - ex-soldier, has chronic cough.
 Mother - in fairly good health.
 Five children in family.
 Emily is third.
 Youngest is in Prestwick with wasting.

Home Conditions:-

Single end with two beds.

Personal History:-

Previous illnesses - Tuberculous glands in abdomen at 7 months. Measles two months before admission to Glenafton.

History of Present Illness:-

On June 9th, 1926, her mother noticed that she was unwilling to walk. A lump on the back which appeared to be painful, was noticed at this time. She also complained of pains in her legs. Six months before this she had severe night sweats. Admitted to Glenafton Sanatorium on 19/6/26. She has persistent ophthalmia in right eye; inflammation in left eye and discharge from right ear after admission. She had a gibbosity in region of 12th dorsal vertebra. She was kept lying on her back all the time she was in Glenafton, and was transferred from there directly here.

Circulation:-

Heart sounds normal.

Respiration:- Breath sounds normal.

Alimentary Tract:- Negative.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- Palpable in groin.

Skeleton:- Normal apart from lesion.

Lesion:-

She has Pott's disease in region of lower dorsal vertebrae. Externally there is no sign of abscess formation. There is a fairly well marked gibbus. X-ray shows extensive disease of the 11th and 12th dorsal vertebrae, with a sausage shaped abscess running along both sides of the vertebral column, and terminating at the level of the fourth dorsal vertebra.

Case Notes:

26/3/27. On Spinal board with sand-pillow below gibbus, and boot extension. Foot of bed raised four inches. Appears quite comfortable.

1/7/27. The general condition of this child remains excellent. The local condition has not progressed. She should ultimately do well.

1/10/27. The general condition of this child is good. The local condition shows little change.

10/10/27. X-ray shows ? tracking up of abscess. Blood pressure 90 and 70.

21/10/27. Child died today.

Ten days before death the temperature which had previously had a normal range, became elevated and signs of cardiac embarrassment appeared.

Skiagram failed to reveal any gross change, and in the absence of post mortem evidence it is concluded that the abscess interfered with structures in the mediastinum. Pulse rate before death was nearly two hundred and she was very exhausted. Possibly the abscess ruptured into the pericardium.

CASE IV.

A case of cervical caries, with sinus formation, demonstrating the diagnostic use of lipiodol. Radiograms were too poor for reproduction.

John Douglas Gibson. Aged 4. Admitted 17/2/27.

Family History:-

Nothing of note.

Home Conditions:-

New three apartment house.

Personal History:-

Feeding - Various artificial foods.

Previous Illnesses:-

During the first few weeks of life great trouble was experienced in feeding him. At 3 months he weighed $3\frac{1}{2}$ lb. Later curd mixture was found to suit. Thereafter healthy till 2 years of age, when he had whooping cough. This was not a severe illness, but about this time there is a record of slight accident to neck.

History of present illness:-

In June 1925 definite rigidity of neck was noticed but it is suspected that this was present from the previous February i.e. when the whooping cough was going on. Went into Ayr County Hospital on 1st July and was there for 3 months for observation. A fortnight after dismissal he was re-admitted with severe tonsillitis. He was kept in for a month and discharged with a splint. Bronchitis at New Year time was followed by lump in neck in April 1926, which was opened and drained. Wound healed in December 1926.

Circulation:- Normal.

Respiration:- Normal.

Alimentary Tract:- Teeth decaying. Abdominal examination reveals no abnormality.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- Palpable in neck.

Skin:- Von Pirquet positive.

Skeleton:- Apart from lesion there is no abnormality.

Lesion:- Pott's disease of the cervical spine.

There is a recently healed cicatrix on the right side of the neck, behind the sterno-mastoid muscle. The neck appears to be short, and the head is carried slightly inclined forwards. The muscles of the neck, except the sterno-mastoids, are very flabby. There is no spasm, and pain appears to be absent.

There is a limited range of movement of the head. He can flex his head through an angle of 10° , and can rotate it laterally through an angle of about 20° . He cannot extend his head beyond the upright position. There is no deformity of the spine.

Case Notes.

1/4/27. Three skiagrams were taken, and the disease seems to affect mainly the 5th and probably to some extent involves the 4th and 6th cervical vertebrae.

His general condition is good.

He developed chickenpox shortly after admission and has been kept recumbent.

1/7/27. Child has been immobilised in a plaster shell.

The sinus was injected with bismuth and paraffin paste and skiagrams were taken. The tract was found to extend downwards towards the mediastinum where a mass of enlarged glands can be seen. It extended upwards also to the base of the skull in the line of the great vessels. It did not lead to a bony focus, so it may be concluded that the disease in the vertebrae is now quiescent.

1/10/27. Child has been removed from plaster shell. If anything the discharge from the sinus is not so marked.

The clinical signs still seem to indicate that activity of the disease in bone has ceased, but the pulmonary condition still persists.

25/12/27. Child is constantly in the ventral position during the day, but has not yet been allowed up. The general condition has improved very much. His sinus has closed, and the anteflexion of the neck is being masked by compensatory curves in the dorsal spine. The disease in the mediastinum is quiescent.

25/3/28. This boy is now moving about freely in bed. He continues to make uninterrupted progress, and will soon be up and running about. The anteflexion of the neck is being masked by a compensatory curve of the dorsal spine.

Chest condition seems to be inactive.

1/7/28. Celluloid jacket has been fitted. This boy is almost ready for discharge. His general condition is good and the deformity has been masked by compensatory curves of the spine. The disease seems to be arrested.

1/10/28. Simple recumbency.

This boy has been kept because of marked exercise temperatures. There are tending to disappear and he will be discharged next week. The disease in the cervical vertebrae is arrested.

1/1/29. Sinus reopened and the boy had to be returned to bed. Sinus was injected with lipiodol, and it was found that the condition was almost confined to the surface.

The general condition of this boy is good and his temperature, which was slightly elevated a month ago, has now returned to normal. There is practically no discharge from the sinus. When it is healed he will be discharged.

16/2/29. Discharged afebrile and on full activity.

CASE V.

An uncomplicated case of upper dorsal disease with prevertebral abscess.

Robert Walker. Aged 20. Admitted 28/4/30.

Family History:-

Nothing of note.

Home Conditions:-

Room and kitchen. Damp.

Personal History:-

Had pneumonia and pleurisy when 16 years of age. No other illnesses, infectious or otherwise.

History of Present Illness:-

On 12/12/29 patient complained of pain in the left side of the chest, and his doctor treated him for a fractured rib. Early in January a lump was noticed in the back but he had no pain. He was sent to the Western Infirmary for radiological examination, and a diagnosis of Pott's disease involving the 5th dorsal vertebra was given. The County Health Department was notified and his admission here followed. He has not been confined to bed before admission.

Present Condition:- Good.

Circulation:- Normal.

Respiration:- Normal.

Alimentary Tract:- Teeth and tonsils good. Nothing abnormal in abdomen.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- None grossly enlarged.

Skin:- Von Pirquet positive.

Skeleton:- Nothing abnormal apart from lesion.

Lesion:-

There is a gibbus in the dorsal region at the level of the fourth and fifth dorsal spines. The movements of the spinal joints of this region are abolished and on flexion of the spine the curve is flattened in this region. Radiogram shows almost complete destruction of the body of the 5th dorsal vertebra with the bodies of the 2nd, 3rd, and 4th involved to a lesser degree. A pre-vertebral abscess is present and is tracking downwards.

Case Notes.

1/7/30. Treatment. Fixation in plaster shell. The general condition of this boy remains good. He is lying well in his shell. The lesion is still active, and the period of treatment will be a long one.

1/10/30. This boy is in good general condition. The disease does not appear to be advancing. The lesion is a bad one, and the prognosis must be guarded.

1/1/31. The boy remains in good general condition. There is no evidence of advance of the disease and no sign of pressure on the cord.

1/4/31. This boy continues to do well. He has gained weight considerably during the past quarter, and there is no sign of advance of the disease.

1/1/32. This boy continues to do well. There is no sign of advance of the disease, and his general condition is excellent. He will be recumbent for some months yet.

1/4/32. His general condition remains good, and the disease has shown no signs of advance for months. His period of recumbency is drawing to a close but he has not yet been allowed to assume the ventral position.

12/4/32. He is now in the ventral position.

26/4/32. He is up standing and a cast has been taken.

9/5/32. He has been provided with a celluloid jacket and is going home this week.

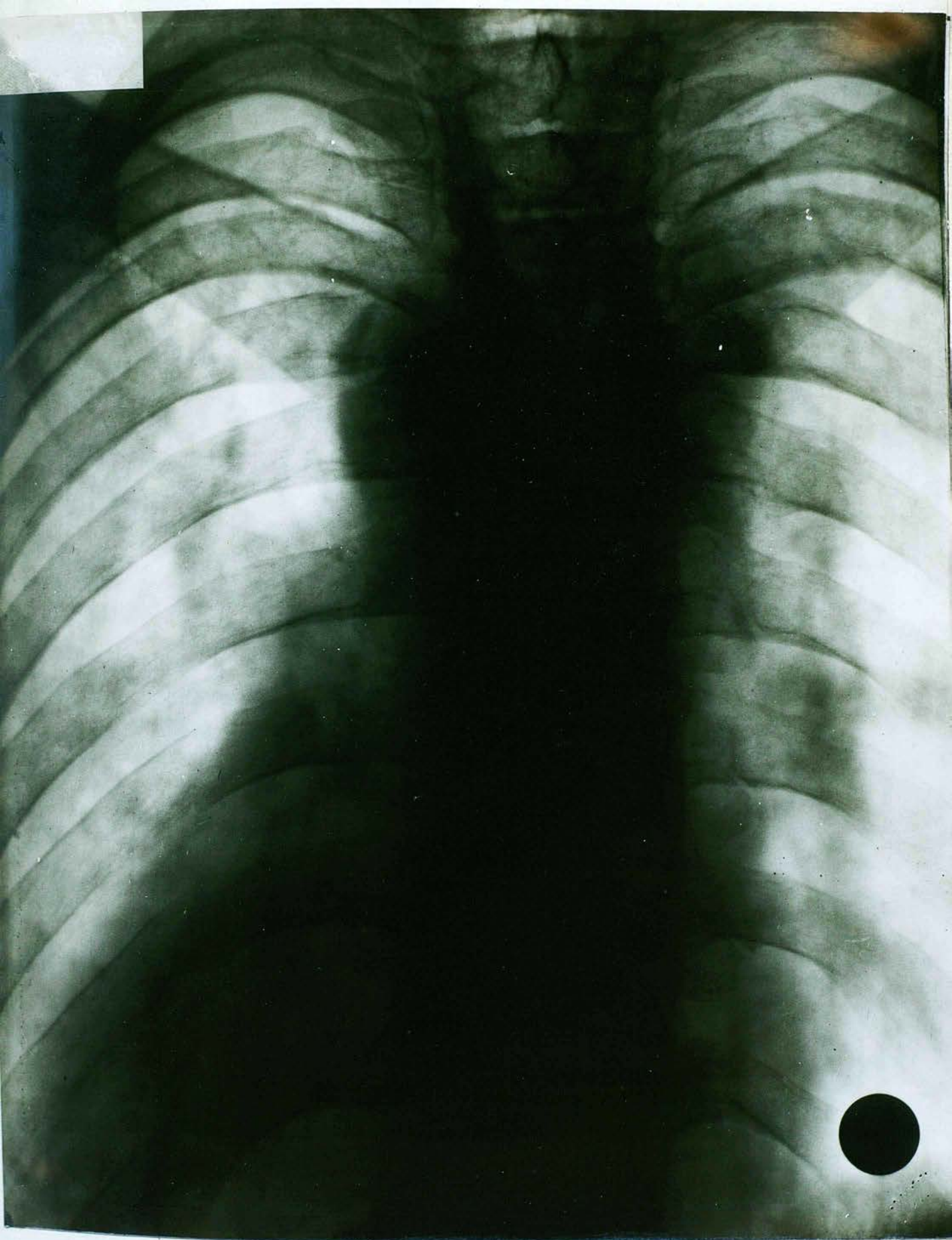
Discharge Report:-

The disease in the spine appears to be arrested and good

compensatory curves are present. His general condition is good and he walks fairly well though he has only been up for about a fortnight. He must be considered as a convalescent for the next nine months.

Robert Walker.

- (1) A.P. radiogram over-printed to show crowding of ribs
and outline of prevertebral abscess.
- (2) A.P. radiogram under-printed to show almost complete destruction
of the fifth body and adjacent disc. on







Photograph 3.
Front view of the boy
on admission - Feb.1926



Photograph 2.
One stage in the production
on compensatory curves.

CASE VI.

A very interesting case, showing the production of compensatory curves in a marked gibbosity.

John Harper. Age 11. Admitted 4/2/26.

Family History:-

None obtainable.

History of Present Illness:-

None obtainable, but the boy states that he has had his gibbosity for at least two years.

Circulation:-

Hb 85%: R.b.cs 4,000,000: W.b.cs 9,000. Heart sounds are pure and there are no murmurs.

Respiration:-

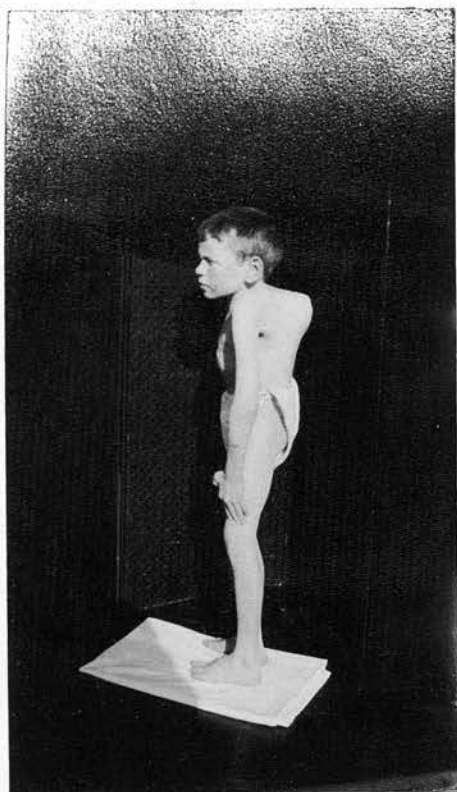
Considering the shape of the chest, the respiratory murmur is very clear. There are no rales or other adventitious sounds.

Alimentary Tract:-

Teeth are good. Tongue is clean. Bowels move normally. Abdominal examination is negative.

Urinary System:- Nothing abnormal.Nervous System:- Normal.Lymphatic Glands:- Slight enlargement of right posterior cervical glands.Skin:- Von Pirquet markedly positive.Skeleton:- No abnormality apart from lesion.Lesion:-

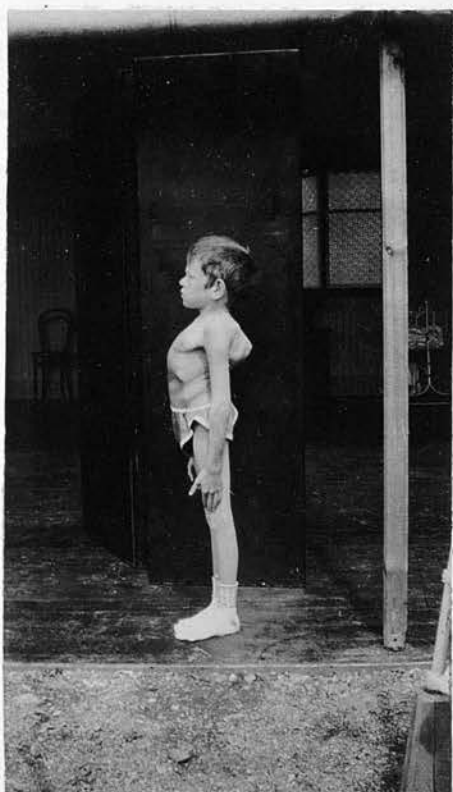
Patient has a very marked gibbosity of his dorsal spine (photographs 3 and 4). The sternum is very much curved, with the convexity anteriorly. The lower ribs are at the level of the iliac crests. The patient cannot stand at attention for any length of time, and when standing at ease for a prolonged period he adopts a crouching attitude.



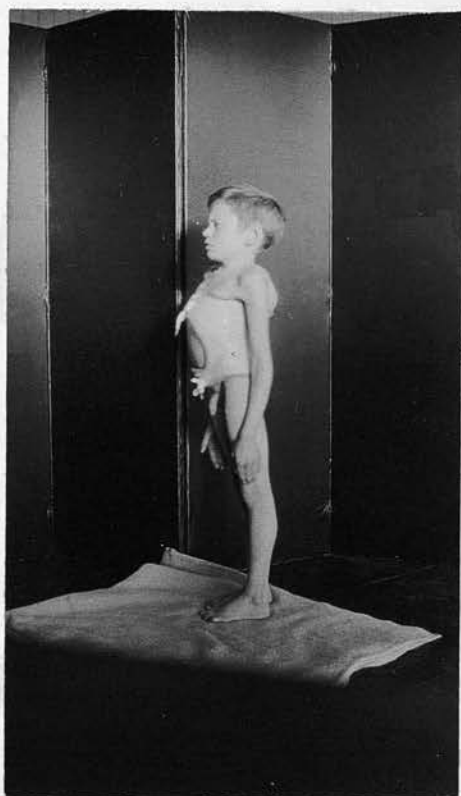
Photograph 4.
Feb. 1926 - The boy
on admission.



Photograph 5.
April 1926 - Compensatory
curves already appearing.
Note the changed position
of head and knees.



Photograph 6.
August 1926 - Again note
increased spinal curves
and the great change in
the position of the head.



Photograph 7.
January 1927 - He is now
fitted with...

There is no external evidence of abscess formation. See radiogram.

Case Notes:-

19/2/26. Patient has been in ordinary bed since admission. His general condition has improved very much.

20/2/26. Patient was put in a special bed, hinged opposite gibbosity, to allow of lower end tilting up. (Photograph 2). It was noticed that his pupils dilated when the foot of the bed was raised. This may be due to the viscera pressing on the cervical sympathetic.

28/2/26. Sand pillow below gibbosity. Patient quite comfortable. The pupils are now practically normal.

28/4/26. Patient fitted with boots and fixed with them to foot of bed.

22/5/26. Patient in head extension, plus foot extension.

This arrangement will allow gravity to act on the shoulder girdle and reduce the deformity gradually.

General health is now excellent.

22/6/26. Patient allowed up.

4/8/26. Plaster jacket applied to prevent loss of compensatory lordosis.

13/8/26. Plaster jacket removed. Patient put in ordinary bed in ventral position during the day and lying on his side at night.

7/9/26. Patient is now back in his special bed for another course of extension. He is extended both by head and feet. He appears to be quite comfortable. His ligamentum nuchae can be palpated, and is on the stretch.

18/9/26. He is still on his special bed. A plaster jacket was made on 13/9/26 and removed for mould. He is still doing well generally.

13/10/26. Still in his special bed. His celluloid jacket is being made. He is eating and sleeping well.

13/11/26. Still in bed. Jacket will be completed in a week. General health is good.

22/11/26. He is now out of bed wearing his celluloid jacket, which maintains the lordosis.

12/12/26. In statu quo.

7/1/27. Discharged. The celluloid corset is designed to retain the compensatory lordosis. It should always be worn during the day, and when it is removed at night a sand pillow completely filling the curve should be used. The boy should be made to sleep on his back.

8/2/29. Readmitted. He is wearing a soft jacket which is allowing his ribs to bear upon his iliac crest. He will be fitted with a new celluloid corset.

11/3/29. Discharged. The new celluloid jacket throws the ribs off the iliac crests, and abolishes pain. With care this jacket should last for a period of two years.

Photograph (1) Lateral radiogram of old case of dorsal Pott's disease showing complete destruction of several bodies. One wonders how the cord manages to escape undamaged in such a case.



CASE VII.

A case of lower dorsal disease, with no gibbus on admission. The disease spread in the column and death took place from a secondary tuberculous meningitis.

Mary Johnstone. Age 5. Admitted 2/6/27.

Family History:- Nothing of note.

Home Conditions:- Room and Kitchen.

Personal History:- Feeding:- Breast fed till one year.

Previous Illnesses:-

Whooping cough at 2 years: measles a year ago: chickenpox at 13 months. Two years ago had very severe diarrhoea, which lasted for several weeks.

History of Present Illness:-

Some months ago she complained of pain in her back. Pain came and went a good deal, and seems to have been situated over the lumbar region. Three weeks ago she had a fall and complained of abdominal pain.

Dr. Crombie saw her that night, and pointed out a small lump on her back. Has been in bed since then, but is quite able to run about.

Circulation:- Normal.

Respiration:- Normal.

Alimentary Tract:- Normal.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- None palpable.

Skeleton:- Normal apart from lesion.

Lesion:-

There is slight boarding of the spine in the lower dorsal region. The child does not appear to have any pain and

walks normally.

Case Notes.

13/6/27. This child is in extension on spinal board with no pillow below site of lesion. X-ray shows early tuberculosis of the 10th and 11th dorsal vertebrae, with small spindle-shaped prevertebral abscess.

4/7/27. General condition is beginning to improve.

1/8/27. Treatment as before. Spine in statu quo.

9/8/27. X-ray today shows destruction of 10th dorsal vertebra, but the abscess is diminished in size.

31/10/27. Doing well.

14/11/27. Spine of the 10th dorsal vertebra is moving laterally and there is slight crepitus. Evening temperature has been slightly above the normal line, but X-ray shows little change.

21/11/27. Nutrition appears to be excellent, but she still raises her temperature in the evenings.

28/11/27. There is now a pillow below the gibbus. She is complaining of pain in the right ear. She is still febrile.

5/12/27. Temperature has been settled for the past few days. There are no complaints of pain in the ear.

12/12/27. Temperature is not yet normal. The child is better and complains of no pain.

19/12/28. Child much improved. No temperature.

9/1/28. Temperature again shows a few rises: otherwise in statu quo.

20/2/28. This child appears to be going on well, but the evening temperatures have been unduly raised during the last fortnight.

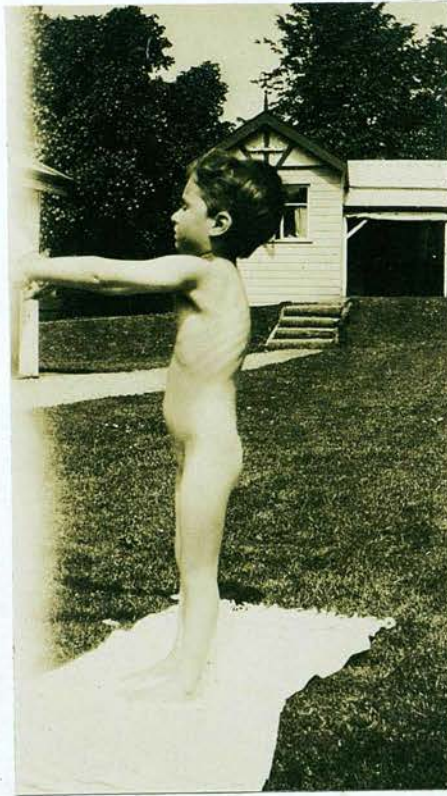
27/2/28. Elevation of temperature still continues and external examination suggests that other vertebrae have become involved.

5/3/28. Radiograms show that the abscess has increased in size and that it is tracking upward. Three verte-

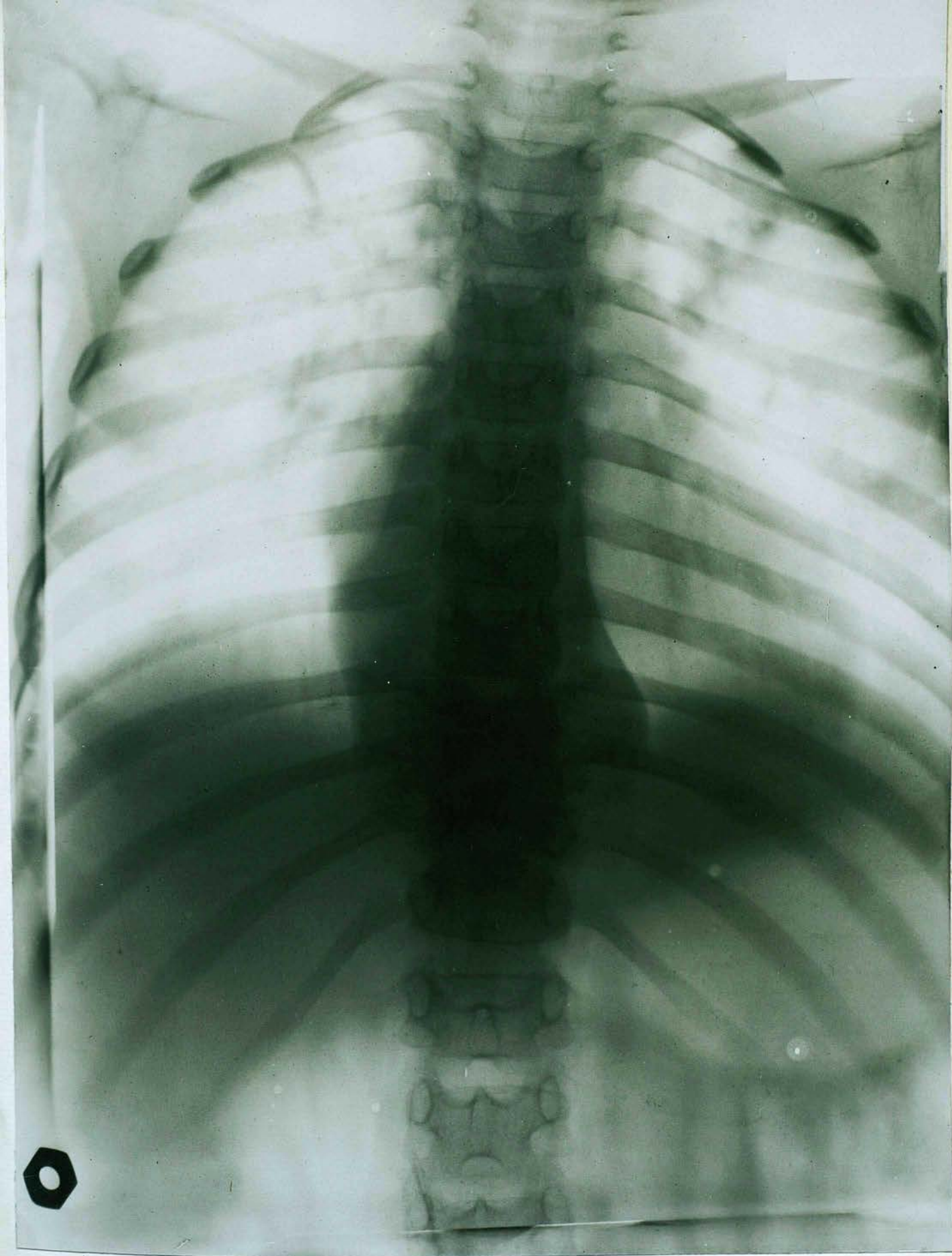
brae are affected. During this week the temperature has gradually settled, but it is still above the line, and the child is far from well.

12/3/28. At the beginning of last week meningeal signs appeared in the way of drowsiness and vomiting. Towards the middle of the week she became comatose. A lumbar puncture yielded clear fluid not under pressure. Now she has rigidity of neck muscles, ptosis of the left eyelid, internal squint of the left eye, and unequal pupils which are slow to react to light. She has retention of urine, is still comatose but can swallow.

14/3/28. Died from a basal tuberculous meningitis secondary to her spinal disease.



- (1) Photograph of child suffering from Pott's disease of the lower dorsal column, showing absence of gibbus on admission.
- (2) Radiogram of the same showing large prevertebral abscess



CASE VIII.

A case of dorso-lumbar disease, with large psoas abscess and sinus formation.

Lily Bradley. Age 14. Admitted 15/4/31.

Family History:-

Patient is third youngest of eight. Another died before patient was born (30 years ago) of meningitis.

Home Conditions: Room and Kitchen. Five occupants.

Personal History:-

Measles, Scarlatina, Whooping cough.

History of Present Illness:-

About six weeks ago the parents noticed that she was inclined to be stiff in the back, but the patient did not complain of pain until two weeks ago. She complained of pain in the back when it was touched, and a few days following she was noticed limping, and a lump appeared in the groin. When this was seen she was taken to hospital and X-rayed the following day. She was then sent home to bed and visited by the tuberculosis officer.

Circulation:- Heart sounds normal.

Respiration:- Normal.

Alimentary Tract:- Teeth good. Tonsils large. Abdomen negative except for large psoas abscess in the right iliac fossa.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- None palpable.

Skin:- Dry. Unhealthy scar tissue on dorsal aspect of right forearm and over external condyles of both humeri. Elbow joints normal. Von Pirquet positive.

Skeleton:- Nothing apart from lesion.

Lesion:-

Rigidity and limitation of movements of flexion and ex-

tension of the whole of the lower spine are present. Pain is not marked.

There is no gibbus, but the spine of the 12th dorsal vertebra is displaced laterally to the left. A large psoas abscess is present on the right and has tracked down below Poupart's ligament into the groin. Fluctuation from groin to abdomen is readily elicited. The skin over the abscess is sound.

Radiograms: (1) A.P. The disc between the 12th D. V. and 1st L.V. is destroyed and the disease also affects the body of the 12th D.V. which is tilted to the right. (2) Lateral. This view shows the destruction of the disc below the 12th D.V. and of the lower portion of the body of that vertebra.

Aspiration of the abscess on admission yielded 350 ccs. of pus, which contained tubercle bacilli of human type.

Treatment:-

Immobilisation in plaster shell. Aspiration of abscess as required.

Case Notes:-

1/7/31. The general condition of this girl is improving. Abscess at first yielded almost 800 ccs. of pus and, although the cavity is still filling up, there is now under 300 ccs. obtainable.

1/10/31. The general condition of this girl is now good. Skin has remained sound over the abscess, and aspiration from the pelvis, extraperitoneally, has been carried out seven times. The quantity of pus obtainable is diminishing. The disease is still very active, but the case looks a good one.

1/1/32. Her general condition is excellent, and, although there is still some fluid in the psoas sheath, aspiration has not been necessary during the whole of the quarter.

1/4/32. The general condition of this girl remains good and radiogram of 19/1/32 showed no advance of the disease. Abscess burst without warning in outer aspect of the thigh with much blood-stained discharge. By 11/3/32 temperature had settled again. There is little discharge but the sinus is widely open. There is no collection now in the pelvis. So far secondary infection has been avoided, and the girl is afebrile.

1/7/32. The general condition of this girl remains good, and there is now very little discharge from the sinus. Secondary infection of the sinus track has been avoided and a good result is anticipated.

1/10/32. The general condition of this girl has improved and the sinus in the thigh has now firmly healed.

1/1/33. The general condition of this girl remains good. The sinus has remained closed during the quarter and healing is firm. She must be kept recumbent for some time yet.

1/4/33. She is now in the ventral position, and is about to commence standing exercises. The ultimate result should be good.

1/7/33. Treatment is now ambulatory. She is in good general condition and is up daily wearing a celluloid corset. There is no deformity, and the disease is arrested.

21/7/33. Discharged today. Her general condition is good, but she is thin by nature.

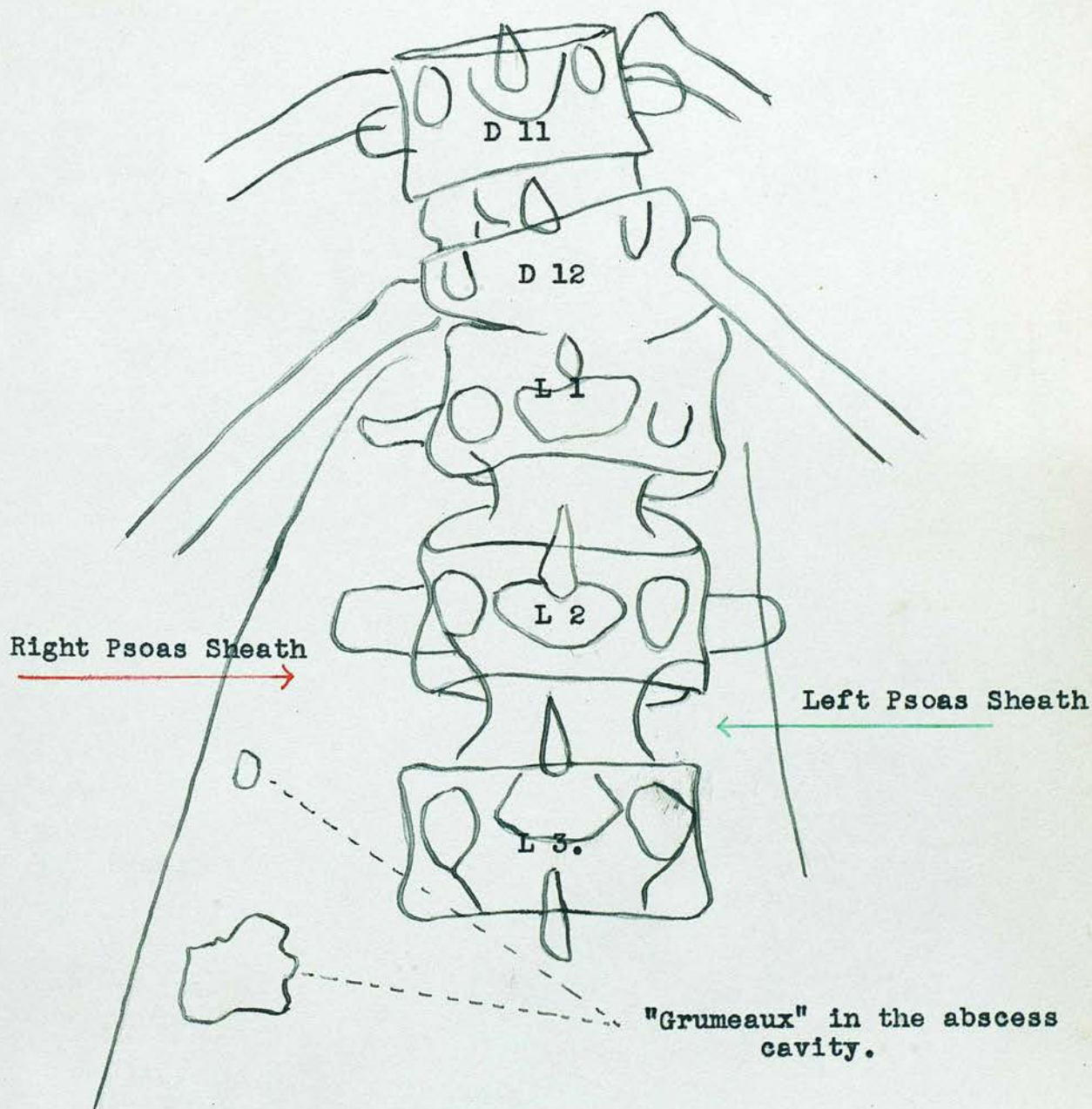
The disease is arrested, and radiograms show no change from those taken twelve months ago. Abscess is dry and sinus soundly healed.

Lily Bradley.

- (1) Antero-posterior radiogram showing destruction of the disc between the 12th dorsal and first lumbar vertebrae, also lateral deviation of the column following lateral destruction of the body of the twelfth.
- (2) Outline drawing showing points in the negative not revealed by the print.
- (3) Lateral radiogram showing destruction of disc. Note the absence of kyphosis.

Lily Bradley.

This outline drawing shows bulging of right psoas sheath as seen in the negative. The reader will readily understand that prints of several intensities are necessary to bring out all the features of any one negative.





CASE IX.

A case of lumbar disease with complete cure.

Anna Borland. Age $3\frac{1}{2}$. Admitted 8/12/26.

Family History:- Nothing of note. Only child.

Home Conditions:- Room and Kitchen. Good house.

Personal History:- Breast fed for one year.

Previous Illnesses:- Bronchial catarrh and alopecia.

History of Present Illness:-

In November 1925 child complained of pain in the back. Spinal curvature diagnosed by Dr. Tait in May 1926. In Davidson Hospital, Girvan, for one week. In July case notified to Ayr County. Sent to Seafield Hospital on August 17th. Discharged from there in the middle of November.

Circulation:- Heart sounds normal.

Respiration:- Breath sounds normal.

Alimentary Tract:- Abdominal examination negative.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- Palpable in neck.

Skin:- Von Pirquet strongly positive.

Skeleton:- Normal apart from lesion.

Lesion:-

There is a slight prominence over the 2nd and 3rd lumbar vertebrae. X-ray shows that there is partial destruction of the bodies of the 2nd and 3rd lumbar vertebrae. No sign of abscess formation.

Case Notes.

1/1/27. Treatment: Immobilisation. The child is only recently admitted. She looks as if she would do very well.

1/4/27. This child has improved generally. There is no abscess formation and little deformity. She is a good case and should do well.

1/7/27. Immobilisation on spinal board with sand pillow below gibbus.

The general condition of this child remains excellent. Recent skiagram showed continued absence of abscess formation and probably arrest of disease.

1/10/27. Immobilisation on spinal board, with hyper-extension of spine.

This child has lost weight during the summer, but there is nothing to indicate that the disease is advancing. She is afebrile, and seems to be doing quite well.

1/1/28. This child has improved very much generally during the quarter. She has put on weight, and eats and sleeps well. I think the period of activity of the disease is almost past.

1/4/28. The general condition of this child has improved very much. The disease is still mildly active, but further destruction of bone has not taken place.

1/7/28. The general condition of this child remains good. Radiogram of 4/6/28 suggests that the disease is arrested. Signs of consolidation are not yet present. There is practically no deformity.

1/10/28. A radiogram was taken on 3/9/28. The two vertebrae originally affected seem to be soundly welded together, but there is a spot of rarefaction in the fourth lumbar vertebra, which will require to be watched. In the meantime she is not being put in the ventral position during the day, but her general condition warrants it.

1/1/29. The general condition of this child remains good. Radiogram of 3/12/28 showed the condition of the fourth vertebra to be unchanged from 3/9/28. The bodies of the second and third are firmly welded together. She is going on well, but treatment cannot be relaxed yet.

1/4/29. The general condition of this child has improved. Radiogram of 11/3/29 showed the condition of the 4th vertebra to be unchanged from that seen on 3/12/28. She is going on well, but further recumbency is still required.



(2)



(3)

Photographs of the child several years later, - taken in
United States.

1/7/29. Progress has been maintained and the disease is now arrested.

A celluloid corset is being prepared for the child, and it is hoped that ambulatory treatment may be commenced soon.

7/9/29. Discharge Report.

Treatment: Immobilisation in the dorsal decubitus for $2\frac{1}{2}$ years, thereafter ventral position during the day. The disease seems to be arrested. The last two radiograms have shown no change. She has been discharged wearing a good fitting celluloid corset.

Further Progress.

This girl went to America in August 1930, and letters from her mother state that she is growing normally and in very good health. Her spine lesion is giving no trouble.

The accompanying photographs taken in June 1931 show no sign of deformity.

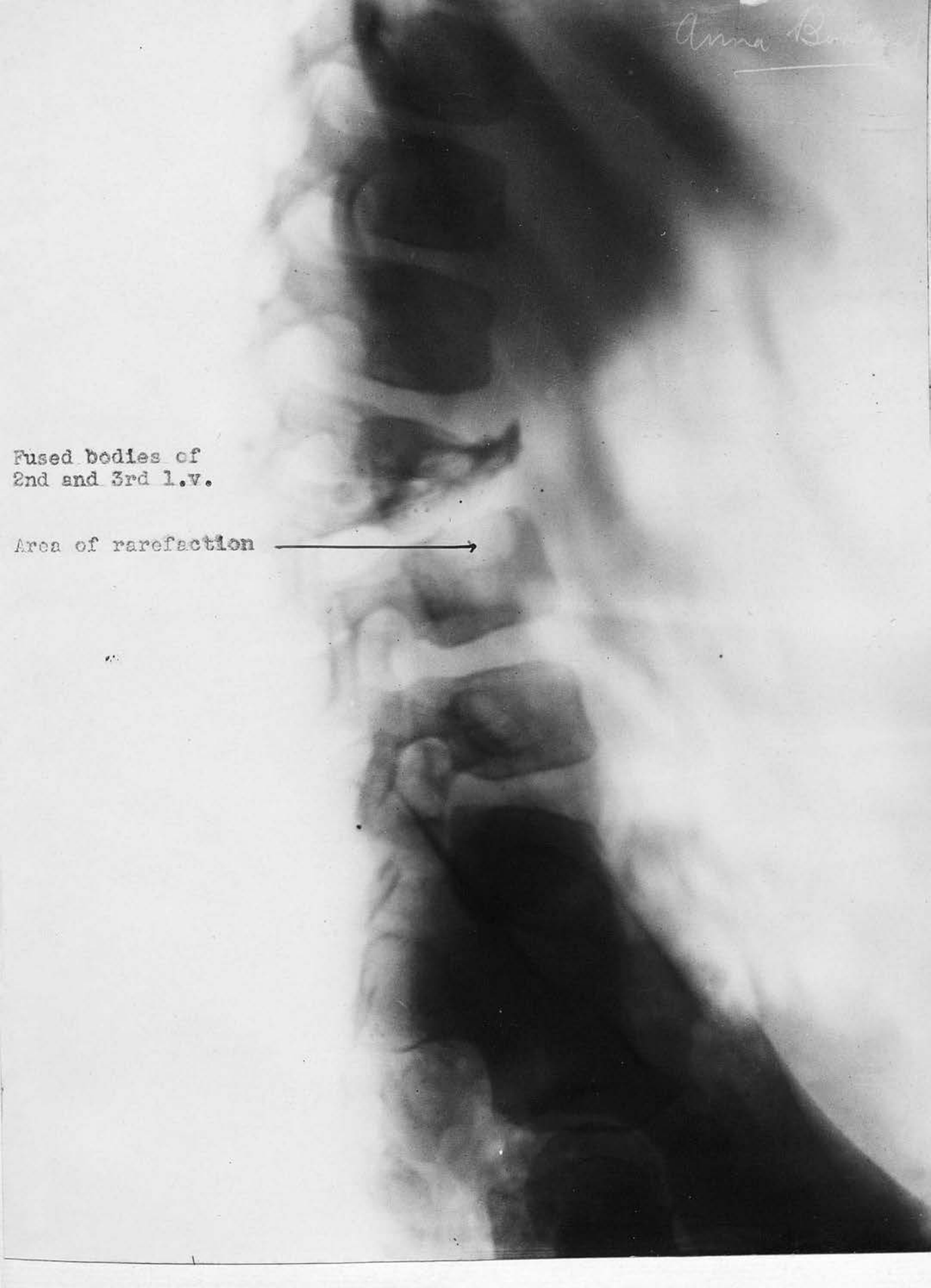
Anna Borland.

- (1) Lateral radiogram of case of lumbar Pott's disease showing destruction and fusion of the remains of the bodies of the second and third vertebrae. Note the crescentic area of rarefaction in the upper half of the body of the fourth. This disappeared in later films.

Anna Bonney

Fused bodies of
2nd and 3rd l.v.

Area of rarefaction →



CASE X.

A case of lumbar Pott's disease, showing also sternal abscess.

Mrs. Mary McCann. Age 33. Admitted 7/7/33.

Family History:-

She is a married woman. Husband alive and well. Four living children who are healthy, and one dead following measles.

Father and mother are still alive and healthy.

Four brothers and two sisters alive and well.

Home Conditions:- Three-apartment house.

Previous Illnesses:-

Measles and whooping-cough. No scarlatina or mumps. Congestion of lungs following measles.

History of Present Illness:-

Three years and nine months ago, three months after the birth of her last child, she had a pain in her right side. She has had this more or less since, and has intermittently had periods of a fortnight in bed. In January of this year she had pain and tingling in both legs and thighs, and a lump appeared between her breasts. She says that the lump was there, though much smaller, three years ago. Three weeks ago she went to the Western Infirmary where the sternal abscess was aspirated and a radiogram was taken. The case appears then to have been notified.

Circulation:- Nil. She is anaemic.

Respiration:- Nil.

Alimentary Tract:- Nil.

Genito-urinary System:- Nil.

Nervous System:- Nil.

Lymphatic Glands:- None palpable.

Skin:- Clear. Von Pirquet positive.

Skeleton:- Nothing apart from lesions.

Lesions:-

There is a small gibbus over the spines of the 2nd and 3rd lumbar vertebrae. There is a fluctuant swelling over the xiphi-sternum. It is one inch broad and two inches long.

Radiogram shows lesion affecting the 2nd and 3rd lumbar vertebrae. There is complete destruction of the 2nd and partial destruction of the body of the third. Some opaque spots are present in the left psoas sheath, but palpation does not reveal a mass in the left iliac fossa.

17/1/33. She has settled down well. There is no obvious change in her condition.

The sternal abscess was aspirated and the pus injected into a guinea-pig.

1/8/33. Little change so far.

McCann.

- (1) Severe lesion of the second and third lumbar bodies.
See also photograph facing p.107.



CASE XI.

A case of 5th lumbar disease with psoas abscess, illustrating the diagnostic use of lipiodol. Excellent results.

George McGovern. Age 20. Admitted 21/3/28.

Family History:-

Father died 14 years ago. Phthisis.
Mother died 8 years ago. Phthisis.
Five in family. Youngest going to a sanatorium soon.

Home Conditions:- Two rooms.

Previous Illnesses:- Measles and whooping-cough in childhood.

History of Present Illness:-

In October last, towards the end of the month, he noticed a swelling in the right groin. He reported this to Dr. Crombie, but continued to work, since he had no pain. In the middle of December the lump was the same in size but a stiffness developed in the leg. He was sent to the Western Infirmary and X-rayed, where a diagnosis of spinal disease was made. He stopped work, and has been in bed since.

The sister, who gives the history, says that he had a pain in the lumbar region about October, and that for four months before the abscess was discovered he was losing weight.

Circulation:- Heart sounds normal.

Respiration:- Normal.

Alimentary Tract:- Normal.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- Palpable in the groins.

Skin:- Von Pirquet strongly positive.

Lesion:-

There appears to be some slight boarding of the spine in the mid-lumbar region. There is a large abscess in the medial aspect of the right thigh.

Radiograms of spine and right hip fail to reveal any gross lesion of bone. General condition is fairly good.

Case Notes.

1/4/28. Treatment: recumbency. This boy's general condition is good. He has been X-rayed twice, but so far the bone lesion has not been definitely located.

1/7/28. The general condition of this boy is very good. The lesion has been definitely localised in the body of the 5th lumbar vertebra. The body is destroyed on the right side, and the column has a slight lateral deviation. The psoas abscess has been aspirated, and lipiodol injected into the cavity has demonstrated the track extending upwards towards the lesion.

1/10/28. This boy is going on well. The abscess has not required further aspiration. It is absorbing rapidly, and the lipiodol which was injected some months ago can be seen on the radiogram in contact with the bone focus.

1/1/29. This boy continues to do well. The abscess is practically dried up, and there is no further destruction of bone. His general condition is good.

1/4/29. This lad is making good progress. The disease is probably arrested. There is no sign of psoas abscess. His general condition is excellent.

1/7/29. The general condition of this boy is good, and the disease is probably arrested. There is no sign of the psoas abscess, and the temperature is constantly subnormal. Ambulatory treatment cannot be attempted for some time yet.

12/8/29. He has been up for about five hours per day. I expect to discharge him at the end of this week.

16/8/29. Discharge Report.

The general condition of this boy is good. He is discharged somewhat prematurely to release a bed, but I think

his home conditions are sufficiently good to allow him to convalesce successfully. The abscess appears to be completely dry, and no sinus formation took place. Radiogram appears to show arrest of the disease.

9/11/29. Re-survey.

His general condition is very good. He feels fit. No radiogram was taken. He bends fairly well, but there is a considerable scoliosis. There is no external sign of abscess formation.

Re-examined in February 1930 before he went to America. Feeling in perfect condition. No limp. Physical and radiographic signs unchanged. Lipiodol still in situ.

George McGovern.

- (1) Healed tuberculosis of the fifth lumbar vertebra. Note lipiodol injected into a closed psoas abscess for diagnostic purposes. It has remained unaltered in the tissues for eighteen months, and is seen in small quantity high up in the psoas sheath.



CASE XII.

A case of osteochondritis vertebralis treated as a Pott's disease. Letter from Calvé is included.

Louisa Alabaster. Age 4. Admitted 21/2/29.

Family History:- Mother 32. Healthy.
 Father 31. Healthy.
 One sister, 7. Healthy.
 No brothers.

Home Conditions:- Room and kitchen. House is damp and is very dark.

Personal History:- Feeding: bottle fed.

Previous Illnesses:-

Measles at three years, but had whooping cough immediately before. She also had broncho-pneumonia at the same time. At this time it was noticed that the right leg was weaker than the left. Dr. Barclay Ness was called in, and the parents were informed that the child was suffering from Infantile Paralysis. Right leg has not grown as the left.

History of Present Illness:-

From the above period until Christmas week the child was up and running about. The right leg was noticeably different from the left. At Christmas time she again had broncho-pneumonia. She complained of hurting her back, and the mother noticed a prominence in the spine. Dr. White was called in. She recovered from the pneumonia, and was sent to the Western Infirmary about the middle of January, where she was X-rayed. She was seen by Dr. Miller on 31/1/29. Was sent to the McAlpine Home for another X-ray. Has been at home since.

Circulation:- Nil.

Respiration:- The ribs are curled outwards at the lower end of the thorax. The sternum is slightly indrawn. Breath sounds in front appear to be normal. At both bases behind there are a few rales.

Alimentary System:- Tonsils slightly enlarged: otherwise no abnormality.

Urinary System:- Nil.

Nervous System:- Nil.

Lymphatic Glands:- None palpable.

Skin:- Von Pirquet markedly positive.

Skeleton:- Nothing apart from lesion.

Lesion:-

This child has not been seen walking, and no attempt has been made to put her on her feet. There is apparent wasting of muscles of thigh and leg on the right, but there does not seem to be shortening. The reflexes are normal. The grip of the hands appears to be equal, and there is no apparent difference in the musculature of the arms. There is a moderately severe gibbus, with apex over the first lumbar vertebra. The spine does not extend normally.

A.P. radiogram shows loss of disc space between 12th dorsal and 1st lumbar vertebrae, and woolliness of the body of the first lumbar. Lateral radiogram shows involvement mainly of the first lumbar. There is no apparent abscess formation.

Case Notes:- Condition on Admission.

1/4/29. Early case of Pott's disease affecting the 12th dorsal and 1st lumbar vertebrae.

Treatment: Immobilisation in the dorsal decubitus.

Present Condition: The child is in fair general condition. Von Pirquet is markedly positive. Radiogram shows loss of disc space between the 12th dorsal and 1st lumbar bodies, but lateral view shows that the destruction is mainly in the first lumbar. The case is a very early one, and should do well.

1/7/29. The general condition of this child remains good, but there is slight evening temperature. Radiogram taken last week shows that the disease is still mildly progressing, but there has been no collapse of bodies.

1/10/29. The general condition of this child remains good, but slight evening temperature still persists. Radiogram of 2/9/29 showed no advance of the disease as compared with the appearance on 17/6/29.

1/1/30. This child has made marked general improvement during the quarter. Radiogram of 2/12/29 showed no advance of the disease and she remains practically without deformity.

1/4/30. Progress has been maintained. She has not been radiographed again, but the clinical signs show no advance of the disease.

1/7/30. The general condition of this child remains good. Radiogram of 9/6/30 shows some rebuilding of the destroyed vertebra. The discs above and below are apparently intact. This is unusual, and there is ground for suspecting that the condition is one of osteochondritis. In any case she will do well. Mr. Girdlestone suggests that it is a staphylococcal infection of low virulence.

1/10/30. The general condition of this child has remained good. Recalcification is evidently proceeding, and the child should soon be ready for assumption of the ventral position. I am still inclined to regard the case as one of osteochondritis of the vertebrae.

1/1/31. She is now free in bed wearing a celluloid jacket. Her general condition remains good. The disease appears to be arrested, and she will soon be up and about.

Resurvey.

27/6/31. She is fatter and there is practically no gibbus. Jacket left for new strap. Walks well. Radiogram taken.

8/9/31. General condition good. Walks perfectly and is practically without deformity. Radiogram taken. Jacket to be discarded.

30/1/32. Radiograms taken. There now remains only slight flattening of the affected body.

1/10/32. Re-examined and X-rayed. She is very fit. As this case showed such a resemblance to the osteochondritis vertebralis of Calvé, the radiograms were sent to him. The following is a copy of his letter in acknowledgement.

Mon cher Confrère,

Je m'excuse de ne vous avoir pas écrit plus tôt au sujet des si intéressantes radiographies que vous m'avez fait parvenir.

Le cas est extrêmement curieux. Il est difficile de le faire rentrer dans un cadre nosologique déterminé. Ce n'est certainement pas de la tuberculose, car il y a en régénération de la vertèbre, ce qui ne se voit jamais dans une lésion de cette nature. Contre l'osteocondrite vertébrale, il faut invoquer la destruction presque complète du disque intervertébral, tout au moins au début de l'affection.

Dans le cas que j'ai décrit pour la première fois et dans les observations qui ont suivi, c'est, au contraire, une des caractéristiques de cette curieuse affection que l'intégrité du disque inter-vertébral, la lésion se fait, en quelque sorte, à l'intérieur du noyau osseux du corps vertébral. J'ai l'impression cependant que c'est à une forme d'osteo-chondrite modifiée qu'il faudrait rattacher cette si curieuse observation. Je vous demande l'autorisation de conserver encore quelques jours les radiographies que vous m'avez communiquées, car si vous m'y autorisez, je voudrais en prendre une reproduction.

Veuillez agréer, mon cher Confrère, avec tous mes remerciements, l'expression de mes meilleurs sentiments,

JACQUES CALVÉ.

The following is my attempt at a translation:

My dear Colleague,

I am sorry not to have written you sooner about the very interesting radiograms you sent me.

The case is a very unusual one. It is difficult to classify it with certainty. It is certainly not tuberculosis, for there has been regeneration of the vertebra, which is never seen in a lesion of that nature. Against osteochondritis, one must take into account the almost complete destruction of the intervertebral disc, at least at the beginning of the disease.

In my first case and in my subsequent publications, on the contrary, one of the characteristics of this curious disease is the integrity of the intervertebral disc.

The lesion in some way or other is confined to the interior of the body of the vertebra. I have the impression, however, that it is as a form of modified osteochondritis that one ought to class this so curious case.

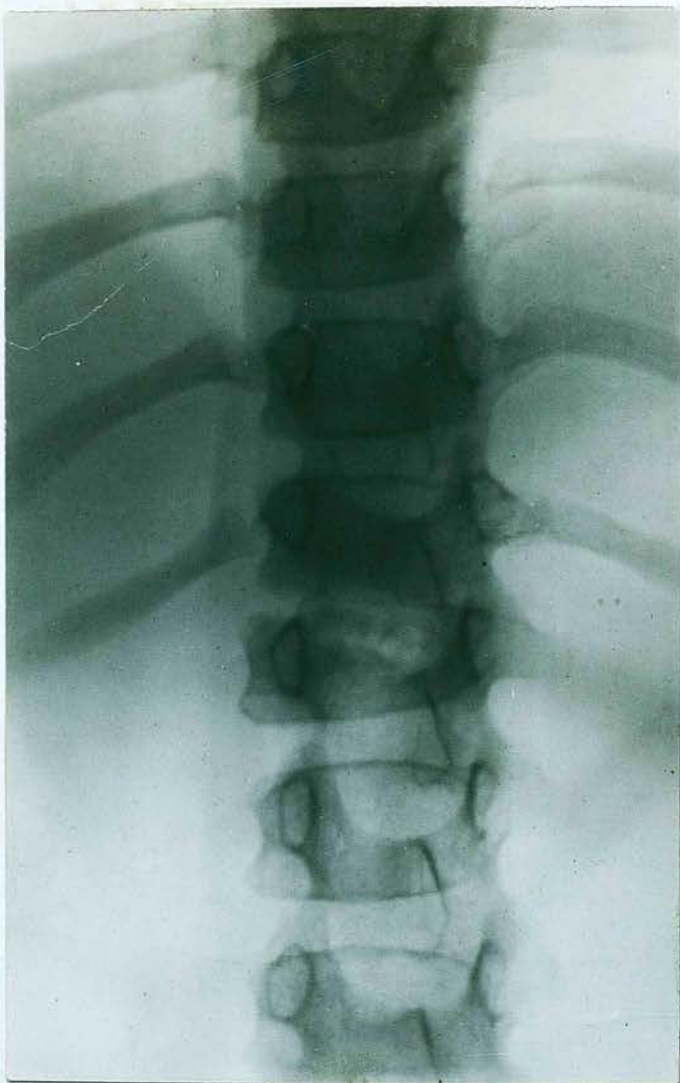
I would like to retain for some days yet the radio-gramms which you have sent me, for, if you give me liberty, I would like to take a copy.

Please accept, my dear Colleague, with all my thanks, my kindest regards,

JACQUES CALVÉ.

L. Alabaster. Case of osteochondritis vertebralis.

- (1) is a.p. view of affected body on admission, showing partial destruction and apparent pinching of the disc.
- (2) a.p. view in October 1932, showing regeneration of the affected bone, as in Perthe's disease, and restoration of the intervertebral disc.



(1)



(2)

L. Alabaster. Case of osteochondritis vertebralis.

(3) and (4) the same as before in lateral view.



(3)



(4)

CASE XIII.

A Case of dorsal disease with large prevertebral abscess. Paraplegia due to oedema developed and passed off in six months. Complete recovery.

Euphemia Walker. Age 13. Admitted 24/10/29.

Family History:-

Father 42, healthy. Mother 42, healthy. Two brothers and two sisters. Last year the youngest brother, aged 6 years, was "threatened with tuberculous peritonitis" and was in Ruchill Hospital for 3 months. Has been quite well since.

Home Conditions:- Room and kitchen.

Personal History:- Feeding: Cow's milk.

Previous Illnesses:-

Appendicitis 1926. Operation in the Victoria Infirmary. Had abscess drained for 6 weeks. Three attacks of pleurisy - March 1928, January and March 1929. The pain on each occasion was on the right side.

History of Present Illness:-

During July of this year the patient's mother noticed that the child was "walking to the side". She did not complain of pain until two weeks ago when she was put to bed. She remained there until admission here.

Circulation:- Normal.

Respiration:- No lung lesion.

Alimentary Tract:-

There is a healed scar in the right iliac fossa from operation for appendicitis with abscess.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- No abnormality.

Skin:- Von Pirquet positive.

Skeleton:- No abnormality except lesion.

Lesion:-

There is a small gibbus in the mid-dorsal region due to prominence of the 7th and 8th dorsal spines. There is definite limitation of the normal flexibility of this region of the spine, but no pain. There is no sign of abscess formation.

Case Notes.

1/1/30. Case of tuberculosis of the spine, the 7th and 8th dorsal vertebrae being almost destroyed. Radiogram showed, in addition, a large prevertebral abscess tracking down into the abdomen.

Treatment: fixation in plaster shell.

Present condition: the general condition of this child is very much improved, and she has put on a considerable amount of weight. Her anaemia has gone and she eats and sleeps well. In spite of the splendid initial reaction, this case must be regarded as a serious one, and a long period of recumbency will be required.

1/4/30. This girl is making excellent progress. Her general condition has remained very good and there has been no advance of the disease in the spine.

6/4/30. She complained of weakness in both legs. There was still voluntary power, but she did not seem to have much muscular power. Sensation was diminished from the umbilicus downwards. There was double ankle clonus and marked exaggeration of both knee jerks.

14/4/30. Radiogram shows slight enlargement of abscess shadow, but otherwise there is no change.

28/4/30. During the past fortnight there has been little change in the condition of this girl. Skin remains good and there is no incontinence. Power in the legs seems to vary. When tested last week she had poor voluntary movement, but yesterday it was reported that she could not lift her legs. Knee jerks are still exaggerated. Ankle clonus is intermittent. At present those signs are to be regarded as due to oedema of the cord.

19/5/30. She had fair range of voluntary movement this week when tested. General condition remains good and skin is sound.

16/6/30. She appears to be going on well. Yesterday voluntary movement was good in both legs. Clonus was still present in ankles, but this is variable.

21/7/30. Clonus still persists but voluntary movement of the legs is free and full.

28/7/30. Going on very well.

4/8/30. Improvement maintained.

1/10/30. Paralysis has passed completely, and she now has full movement and sensation in the legs. Her general condition remains very good and there is no apparent advance of the disease.

1/1/31. This girl continues to go on well. There has been no recurrence of the paralysis. Her general condition is good, and there is no evidence of advance of the disease in the spine.

1/4/31. The general condition of this girl remains good. A recent radiogram showed that there was no advance of the disease.

Her paraplegia has shown no signs of return.

1/7/31. The general condition of this girl remains excellent. She will still be recumbent for several months, and there is no hope of her discharge under nine months. She is making very satisfactory progress.

1/10/31. Her general condition remains excellent, but she will be kept recumbent for a further three months at least. The end result in this case should justify the prolonged period of treatment.

1/1/32. The general condition of this girl remains good. Her period of recumbency is practically over and she should be ready for home in the Spring.

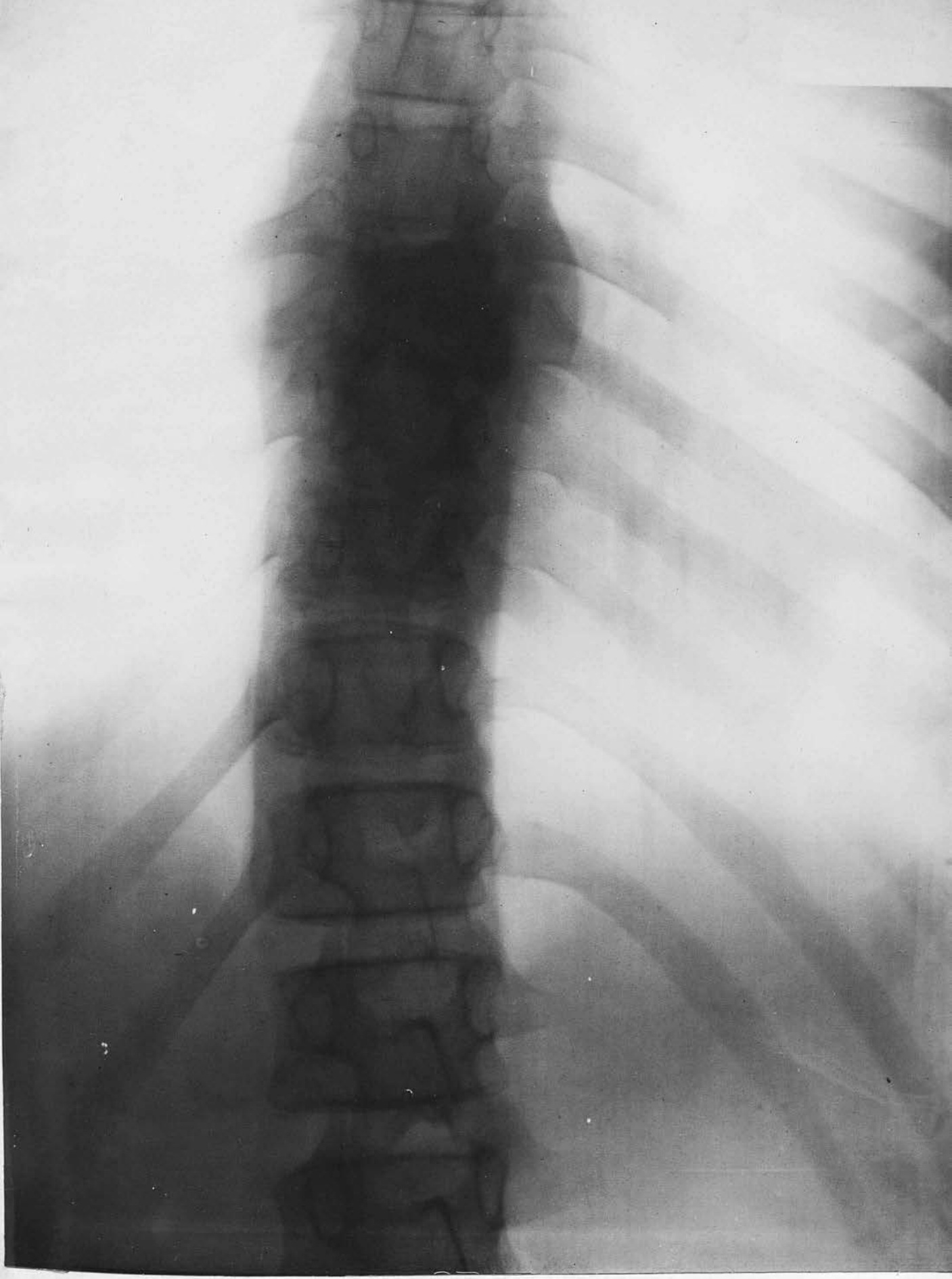
1/4/32. She has now a celluloid support (8/2/32) and is getting up. Her walking is steadily improving, but is not yet sufficiently good to warrant her discharge. Her general condition remains very good.

5/5/32. Discharge Report.

The general condition of this girl is very good. She gained 2 stones 7 lbs. during residence. The disease now appears to be arrested, but she must be considered as a

Euphemia Walker.

- (1) a.p. radiogram showing lesion of the dorsal column.
Note the long narrow prevertebral abscess stretching
from the 6th dorsal body downwards behind the
diaphragm.
- (2) Note the fusion of two bodies in the lateral radiogram.





CASE XIV.

Neglected case of dorsal disease with marked deformity and old hip lesion. Partial recovery.

Dan Sclater. Age 21. Admitted 15/10/31.

Family History:-

Father, chronic bronchitis. Mother, healthy. Two brothers and two sisters. All healthy. Patient is fourth child.

Home Conditions:- Two rooms and kitchen.

Personal History:- Feeding: Breast. Measles.

History of Present Illness:-

At the age of four he fell and complained of pain in the hip, and was admitted to Helensburgh Infirmary for six weeks. He was all right after this for a year but he was taken to the Western Infirmary and a plaster applied to the hip. This was worn for eight months and, when taken off, a curvature of the spine was noticed two weeks later. He was then unable to walk for six months. In the spring of this year he began to experience "pins and needles" in his legs and his walking has since got worse and worse. He was taken to the Royal Infirmary and seen by Mr. Taylor.

Circulation:- Normal.

Respiration:- Asymmetry of chest wall present due to spinal deformity. No intra-pulmonary involvement.

Alimentary Tract:-

Teeth and tonsils normal. Nothing to note in abdomen.

Urinary System:- Normal.

Nervous System:- Increased reflexes and spasm of legs with ankle and patellar clonus.

Lymphatic Glands:- None enlarged.

Skin:- Von Pirquet negative.

Skeleton:-

Nothing apart from hip and spine lesions, and the resultant compensatory skeletal abnormalities.

Lesion:-

The left hip joint is ankylosed in a vicious position of adduction and flexion. He walks with a marked limp in spite of a raised sole of boot, which is necessary to compensate for the marked shortening of the leg.

There is a marked deformity of the upper dorsal spine, the kyphosis being complicated by scoliosis to the right. There is droop of the left shoulder. Exaggerated knee jerks with some loss of voluntary movement of the legs, and the presence of ankle and patellar clonus indicate pressure on the spinal cord. There is some loss of voluntary movement of the legs.

Radiogram of hip shows that great destruction of the head and neck of the femur and of the acetabulum has taken place, but does not suggest that the lesion is active.

Radiogram of the dorsal spine shows great destruction of the upper mid-dorsal vertebræ with much lateral displacement almost amounting to dislocation. The remains of the affected bodies appear as a mass of debris.

Treatment:-

He has been suspended on an inclined plane by his sound leg with a view to gravity reducing the deformity of the spine. It is hoped that this treatment will relieve pressure on the cord.

Case Notes.

16/11/31. Suspended by sound leg.

30/11/31. More comfortable.

7/12/31. Spasm in right leg is not so marked. Babinski and increased knee jerks present.

23/12/31. Still suspended, but spasm is apt to snap the adhesive.

11/1/32. No change. Spasm and jerking of limbs are not decreasing. Generally he is well.

18/1/32. He is now fixed in suspension with strong brown holland adhesive and is not complaining. Sand

pillow below gibbus.

1/2/32. Still suspended.

8/2/32. Spasm of legs still present but less marked.

18/2/32. Still in double suspension. In statu quo.

29/2/32. Spasm much less marked.

11/3/32. Adhesive removed. Legs still show considerable spasm, and reflexes are very brisk.

9/5/32. Knee jerks still very brisk.

18/7/32. There is a definite increase in voluntary movement but reflexes are still brisk. General condition remains good.

1/8/32. Has voluntary control of toes, but cannot move ankles or knees. Reflexes still brisk.

19/10/32. There is definite increased voluntary control of the leg muscles, but still a fair amount of spasm. Passive movements and massage are being carried out.

14/11/32. Improvement continues.

25/1/33. Up standing with crutches.

27/2/33. Getting about well with crutches. Spasm of legs is becoming less.

1/4/33. This youth has made good progress during the quarter. He is up daily, and walks fairly well with the aid of crutches. It is doubtful yet whether he will be fitted with a spinal jacket or not. A little suspension and a great deal of help from nature have made a wonderful change in his condition. He is a good patient and intelligent, and he should again be fit for the clerical work in which he was engaged before admission.

18/4/33. Improvement continues.

3/5/33. Discharge Report.

This boy has been discharged in fairly good condition.

Sclater.

- (1) a.p. radiogram showing severe lesion of the dorsal column. Abscess shows marked signs of inspissation. One wonders at even partial recovery from paralysis in this case.



CASE XV.

A case of dorso-lumbar disease with two abscesses in the flanks, illustrating the diagnostic use of lipiodol. Active disease of the left hip was also present. This case shows the difficulties experienced in treating the double lesion.

Cathie Little. Age 22. Admitted 17/11/27.

Family History:-

Mother alive and well, aged 44: father alive and well, aged 48. Family of nine, of which patient is the eldest. Others all well.

Home Conditions:-

Has been constantly in domestic service since she was sixteen. Conditions good.

Personal History:- Feeding: breast-fed baby.

Previous Illnesses:-

Measles in infancy. Knocked down by tramcar at age of four. Three months afterwards she had meningitis and was very ill. She had enteric fever during this illness, and her mother became infected and was removed to hospital.

History of Present Illness:-

At age of sixteen she had pain in the left hip, but the condition was regarded as rheumatic and she carried on with her work till August of this year. Her fingers & toes had become swollen and painful last winter. Abscess formation took place and pus was eventually discharged from both hands and feet. She was admitted to the Royal Infirmary, Glasgow, in September, was there six weeks, and was discharged six weeks ago. Lumps have developed round the hip during the past fortnight.

Circulation:- Nil.

Respiration:- Nil.

Alimentary Tract:- Nil.

Urinary System:- Nil.

Nervous System:- Nil.

Lymphatic Glands:-

There are some enlarged glands in the left groin.

Skin:- Von Pirquet positive.

Skeleton: as under lesion.

Lesion:-

This girl was admitted wearing a Thomas's hip splint with high patten on sound leg.

Left hip shows limitation of movements in all directions. There is pain when the joint is manipulated. Measurement fails to reveal any real shortening.

There is a prominent spine over the region of the 12th dorsal vertebra, and on the left flank, about 4 ins. from the middle line and almost over the 12th rib, there is a fluctuant swelling about the size of a pheasant's egg.

Radiograms:-

(1) X-ray shows diminution of joint space in the left hip, some erosion of the upper wall of the acetabulum, but the bone shows signs of hardening rather than softening.

(2) Film of the affected region of the spine shows wasting of the intervertebral disc between 12th dorsal and 1st lumbar, and erosion of the bone on the left lateral aspect of both bodies, resulting in an angled scoliosis.

Abscess cannot be distinguished.

Case Notes.

28/11/27. Treatment: complete plaster fixation of hip and spine. The plaster includes ankle, knee, and hip of the affected side, and extending upwards to the axillae. Windows are cut over gibbus, abscess, internal malleolus and abdomen.

12/12/27. Edge of plaster cut to relieve pressure on sacrum.

6/2/28. Plaster was removed today. The abscess is much larger, and the skin round it has become roughened by the edges of the plaster. Aspiration will be delayed for a few days.

13/2/28. Abscess was aspirated on Tuesday, when 114 ccs. were withdrawn. Blood then appeared. On Sunday aspiration was again carried out, and 150 ccs. withdrawn.

The abscess seemed to be empty, and what looked like a protrusion of bowel took place through the opening.

The pus was very thin with small caseous masses.

1/4/28. Aspiration of the large abscess has been carried out several times. Large quantities of tuberculous pus have been obtained. Her general condition is very good. By injection of lipiodol the abscess was traced to the spinal lesion.

28/5/28. Abscess smaller. In plaster shell.

4/6/28. Radiogram shows natural destruction of the affected vertebral body. Hip seems to be advancing. There appears to be complete destruction of cartilage.

9/7/28. Abscess is not filling. Pillow is being used below knees to give the necessary flexion to affected hip.

30/7/28. Abscess yielded 20 ccs. clear fluid. This will probably be the last aspiration.

4/9/28. Abscess seems to be empty.

17/12/28. Radiogram of spine shows no travel of lipiodol. The bodies are in apposition and there is no further destruction. Arrest is probably close at hand.

The hip shows further destruction of bone, but the position is good, and the appearances suggest that the advance has ceased.

29/1/29. Had pains in limbs, dyspnoea, some dullness at bases, quickened pulse, but no temperature. She is better today.

5/2/29. There is dullness on the left side of the chest behind. Radiogram shows opacity in the dull area. Condition is probably due to a pleurisy, as there were friction sounds a few days ago, which have now disappeared.

25/2/29. The dullness at the base has now cleared up.

4/3/29. She is now in the ventral position for two hours daily.

18/3/29. Complains of some hip pain.

15/4/29. Radiogram shows no change in spine. Hip shows advance. There has been an upward movement of about half an inch. She is being extended tomorrow.

2/5/29. Owing to skin trouble extension was removed partially.

4/6/29. She is going on well. There is no pain.

17/6/29. An abscess was discovered today on the right flank.

9/7/29. No change in abscess.

22/7/29. Aspiration was carried out and 24 ccs. were withdrawn. She is easier and the skin, which was threatened, is showing signs of recovery.

29/7/29. Aspiration was tried from periphery yesterday twice unsuccessfully. Eventually 80 ccs were obtained near the seat of pointing.

12/8/29. Aspirated again today - 120 ccs.

19/8/29. Skin will give.

2/9/29. Skin gave about ten days ago. Abscess has almost dried up and she is kept with sterile dressing.

17/9/29. There is practically no discharge.

7/10/29. Radiogram shows no change in spine. Discharge almost ceased. No culture was obtained from injection of a guinea-pig with the pus, hence it is surmised that the active stage of the disease has passed.

1/1/30. The sinus connected with the spinal lesion

has closed during the quarter. In ventral position for several hours daily.

1/4/30. She is now free in bed. She is doing well. The disease in the spine is soundly arrested, and she will soon be fitted with a celluloid corset.

The position of the hip is not so satisfactory as one might have desired, but it was impossible to carry out extension without causing stress on the spine. Her general condition remains excellent.

1/7/30. She is up walking with crutches. A celluloid corset has been made and she is wearing it when up walking. The spinal condition appears to be arrested, and there is no deformity. The same cannot be said of the hip. There is shortening and external rotation, but there is difficulty in procuring traction at the hip in face of the spinal lesion.

The period of treatment has been a very long one, but the period of discharge approaches.

28/7/30. Radiogram of the hip was taken today. There is an appearance suggesting inspissated pus in the pelvis.

Her boot has been raised an inch on the affected side.

1/10/30. She is ambulant. She still walks with crutches, but is able to walk without. She should be kept in residence for some time yet.

16/12/30. Radiogram of hip shows that a lip of bone is being formed to form a roof to a false acetabulum.

Radiogram of spine shows little change, but the lipiodol is still seen in the psoas.

25/12/30. Discharge Report.

This girl is in fairly good general condition. Two abscesses connected with the spinal lesion have healed. There is slight lateral angular deformity of the column, but no kyphos.

Disease in the hip appears to be quiescent.

She has been under treatment here for three years,

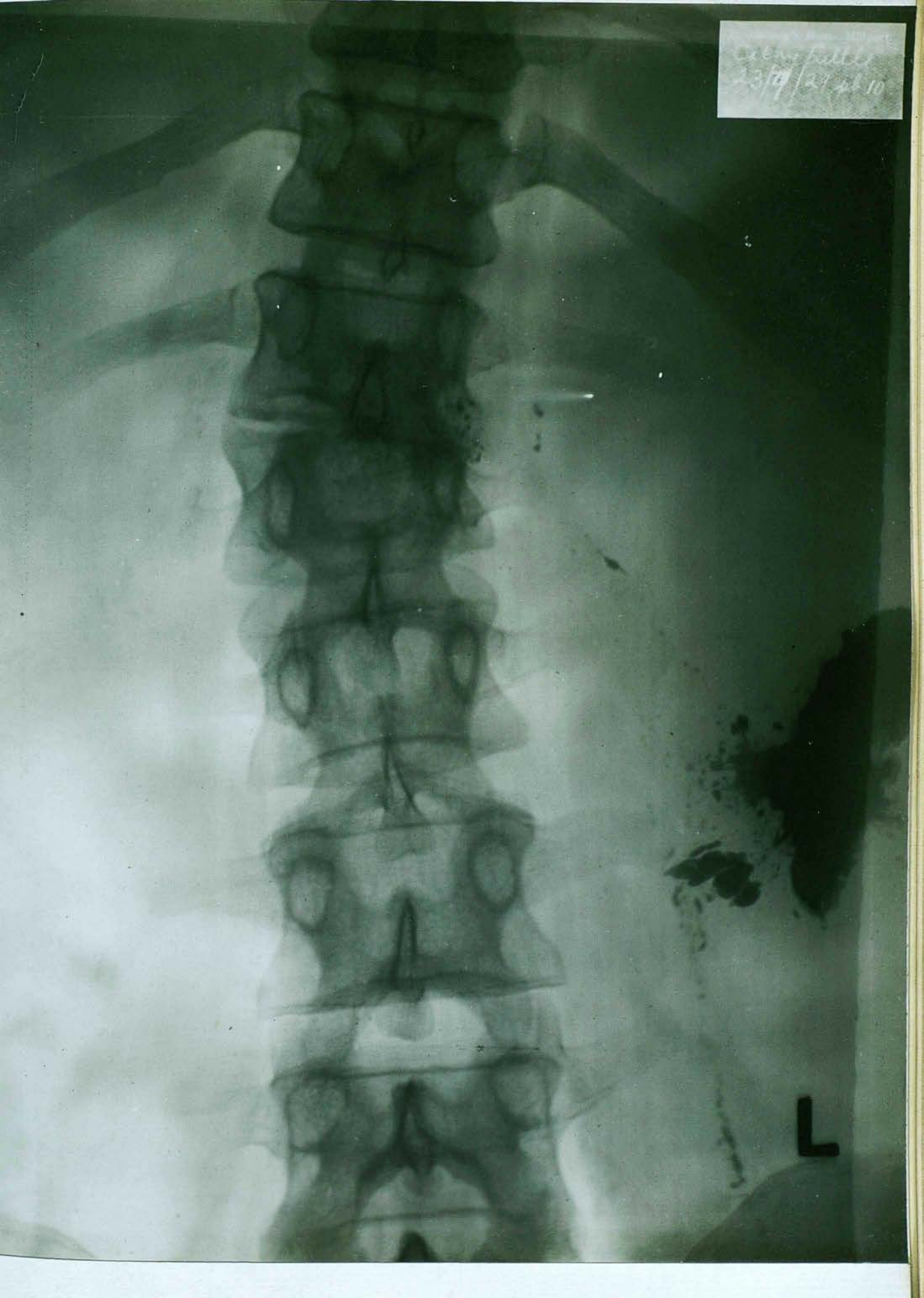
but still requires careful watching. She has been an excellent patient, and I hope she will continue to do well.

Catherine Little.

- (1) Primary lesion of hip.
- (2) Lesion affecting mainly the disc between the 12th dorsal and first lumbar vertebrae. There is some involvement of bone in the first lumbar. The dark mark on the left is lipiodol injected into a closed lumbar abscess after aspiration of the pus. Note how some has penetrated to the lesion. In this case lipiodol was used therapeutically and not for diagnosis, the origin of the abscess being evident.



23/7/27 p. 10



L

CASE XVI.

An interesting case of double lesion in the spine with psoas and prevertebral abscesses, also bayonet deformity. Unfortunately the radiograms, though good enough for diagnostic purposes, were not suitable for reproduction.

Margaret McKinlay. Age 12. Admitted 21/3/28.

Family History:-

Mother 40, healthy. Father 40, healthy. Margaret is an only child.

Home Conditions:- Room and kitchen.

Personal History:- Bottle-fed.

Previous Illnesses:-

Had measles at age of four. No other illnesses.

History of Present Illness:-

At the age of 16 months she fell and hurt her back. Four months later she began to walk with her body to one side, and was X-rayed at the Sick Children's Hospital. The mother stated that she was told that there was something wrong with the spine. The child was then kept in plaster jackets for two years.

At the end of this time a "lump" began to appear in the middle of the back. She was then put to bed and kept in extension (weights on both legs) for one year. After this, at the age of 5½ years, she was fitted with a poroplastic jacket, and has worn one since.

She went to school at the age of 8 years, and was at school till December 1927. In December the mother noticed that she was walking stiffly, and observed a swelling on the inside of one thigh. About a month ago this was seen to be reddening the skin, and a few days later it burst and discharged freely for several days. There is still a slight discharge.

Circulation:- Normal.

Respiration:- Normal.

Alimentary Tract:- Normal.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- Palpable in neck and groins.

Skin:- Von Pirquet positive.

Skeleton:- See lesion.

Lesion:-

There is a pronounced gibbus at the dorso-lumbar region of the spine. There is a healed sinus in the right thigh.

Radiogram of the spine shows what appears to be old disease in the upper lumbar region with destruction of bodies.

In addition there is extensive new disease in the mid-dorsal region with abscess formation. The column shows "bayonet" deformity.

Treatment:- Fixation on spinal board.

Case Notes:-

1/7/28. The general condition of this girl is good. The sinus has healed and she is afebrile. Radiogram shows two foci of disease, one affecting the 1st and 2nd lumbar, the other affecting the 7th, 8th and 9th dorsal vertebrae. In front of the latter is an abscess 4 ins. long by $2\frac{1}{2}$ " broad.

1/15/28. This girl has made good progress during the quarter. She is now in the ventral position, and will soon be able to commence ambulatory treatment.

1/1/29. Treatment is now ambulatory. This girl has been up and about for several weeks. She is afebrile and the disease appears to be arrested. A celluloid corset has been prepared, and when it is properly fitted she will be discharged. Her general condition is very good.

31/1/29. Discharge Report.

The sinus is firmly healed. A good fitting celluloid corset has been made, and this will probably last for two years. At the end of this time I hope to hear that she does not require another. I feel confident that she will do well, considering the advanced state of the disease.

26/9/29. Reported for re-examination. Seemed fit and looked well. Gibbus is in statu quo. Jacket is fitting well, and sinus is soundly healed. The scar can scarcely be seen.

CASE XVII.

A very bad case of cervical disease, with flaccid paraplegia, illustrating the use of head extension apparatus.

Catherine Blaney. Age 18. Admitted 8/8/30.

Family History:-

Father 59, healthy. Mother died of cancer 11 years ago. One sister died two years ago, aged 18, of abdominal tuberculosis. Five brothers, all healthy.

Home Conditions:- Room and kitchen. Good house.

Personal History:- Feeding: cow's milk.

Previous Illnesses:-

Measles, whooping-cough. No other illness.

History of Present Illness:-

She was healthy until about six months ago when she hurt her arm while at work in lace factory. The arm continued to give her trouble, and about two weeks later she first complained of pain in the neck. This was treated by the local doctor, but did not improve, and five months ago she had to take to her bed where she has since remained. She is now almost totally paralysed, and the loss of power dates back roughly six or seven weeks.

Circulation:- Normal.

Respiration:-

There is basal congestion on both sides. There is a fairly wide distribution of moist rales but I do not think that these indicate a tuberculous lesion of the lungs.

Alimentary Tract:-

Very bad stomatitis owing to very poor general condition. Teeth good but dirty. Tonsils coated with exudate. Abdomen is flaccid.

Urinary System:-

Urine clear. There is lack of control of the sphincter, but not actual incontinence.

Nervous System:-

All reflexes abolished below umbilicus.

Lymphatic Glands:- No gross enlargement.

Skeleton:- See lesion.

Lesion:-

There is rigidity of the neck and spasm of the muscles of the neck. There is no definite gibbus, but the neck is short and the movement of the vertebral elements in the region is abolished.

There is a flaccid paralysis of the legs and arms with great wasting of muscle and lack of all voluntary movement.

She is incontinent, but can give warning when the bowel is about to move. The intercostal and abdominal muscles are also involved in the paralysis.

The general condition is so grave that I have not felt justified in attempting to obtain a radiogram.

A small pressure sore is present over the sacrum.

Treatment:-

She was suspended by the head on the inclined plane used in hip cases, so as to give extension of the head, the weight of the body acting as counter-traction.

A head piece of elastic webbing was used, being fitted round the head below the occipital protuberance behind, and above the supra-orbital ridges in front, adjustable in front by means of a buckle. Vertical pieces from above the ears were attached to the top of the bed, which was raised. Sandbags steadied the head on each side, attached also to the head of the bed to keep their weight off the shoulders.

Case Notes:-

18/8/30. Slight improvement. No change in the extent of the paralysis.

25/8/30. Oedema developing, cardiac in origin, affecting feet and legs. Some ascites and basal congestion.

29/8/30. Condition much worse. Oedema very marked. Respiration embarrassed.

2/9/30. Died this afternoon.

CASE XVIII.

A case admitted with right hip-joint disease, which developed a lesion of the 10th dorsal vertebra after 11 months' recumbency.

Alex. McKinnon. Age 11. Admitted 7/8/31.

Family History:-

Father 40, healthy. Mother 46, healthy. Three other children. Patient is the oldest.

Home Conditions:- Three apartment.

Personal History:- Feeding: bottle.

Previous Illnesses:- Only measles.

History of Present Illness:-

About seven months ago he complained of pain in the knee and was treated for rheumatism. Four months later the pain became worse and he developed a limp.

He got no further treatment, and two weeks ago he was X-rayed in Greenock Infirmary, and his admission arranged by the Public Health Authorities.

Circulation:- Normal.

Respiration:- Normal.

Alimentary Tract:-

Teeth decayed. Tonsils average. Abdomen normal.

Urinary System:- Normal.

Nervous System:- Normal.

Lymphatic Glands:- None palpable.

Skin:- Von Pirquet positive.

Skeleton:- Nothing apart from lesion.

Lesion:-

The affected leg, the right, is held normally when in bed, but he has a slight limp when walking. Movements

of the joint are limited as he cannot flex the thigh past 90°, and rotation is very restricted. Full extension is possible, but abduction and adduction are slightly limited. The range of movement which he has is free and painless.

There is distinct muscular atrophy of the right thigh.

Radiogram shows broadening of the neck of the femur in which there are areas both of rarefaction and of scoliosis. An area of periostitis is also seen on the shaft of the femur in the region of the small trochanter.

Treatment is recumbent.

Case Notes:-

1/10/31. There is little change in the condition of the hip joint which is quite painless. There is a persistent slight evening rise of temperature. The radiographic appearances do not suggest tuberculosis and a Wassermann will be done. His general condition is good.

1/1/32. He is now suspended by the affected leg. The general condition of this boy is good. Wassermann was negative, and in view of the marked positive Von Pirquet and the clinical signs it has been thought advisable to treat the condition as tuberculous. There is no sign of abscess formation.

1/4/32. The general condition of the boy remains good, but a recent radiogram shows that the destructive process in the neck of the femur has been progressing, and the rarefied area is more extensive. There is now little systemic disturbance and his temperature remains settled.

1/7/32. The general condition of this boy remains good. There is no sign of abscess formation. Radiogram of 23/5/32 showed advancing sclerosis around the rarefied area in the neck of the femur. The head was still intact.

3/7/32. On routine examination a prominence of the spine of the 10th dorsal vertebra was noted. Radiogram showed a lesion of the 10th dorsal vertebra with involvement of the disc between the 10th and 11th bodies. The A.P. radiogram showed the presence of a prevertebral abscess.

So far as the hip was concerned, the diagnosis was in doubt, but the present finding practically confirms that the disease is tuberculous.

He has been fitted with a plaster jacket and hip spica combined.

1/10/32. He is now fixed in a plaster shell from nape of neck to foot.

He has remained afebrile during the quarter, and there has been no sign of tracking of the prevertebral abscess.

He certainly appears to be going on well, but prognosis must be open to doubt when lesions become multiple as in this case.

1/1/33. His general condition has remained good and the hip is held in good position by the leg piece of the shell. There is no increase in the prominence of the gibbus and the prevertebral abscess has not tracked into the abdomen. Prognosis appears a little brighter.

27/2/33. The gibbus is more prominent and very sharp. He appears well generally.

22/5/33. The gibbus is more prominent in spite of the immobilisation, but his general condition remains good. Hip keeps fairly straight.

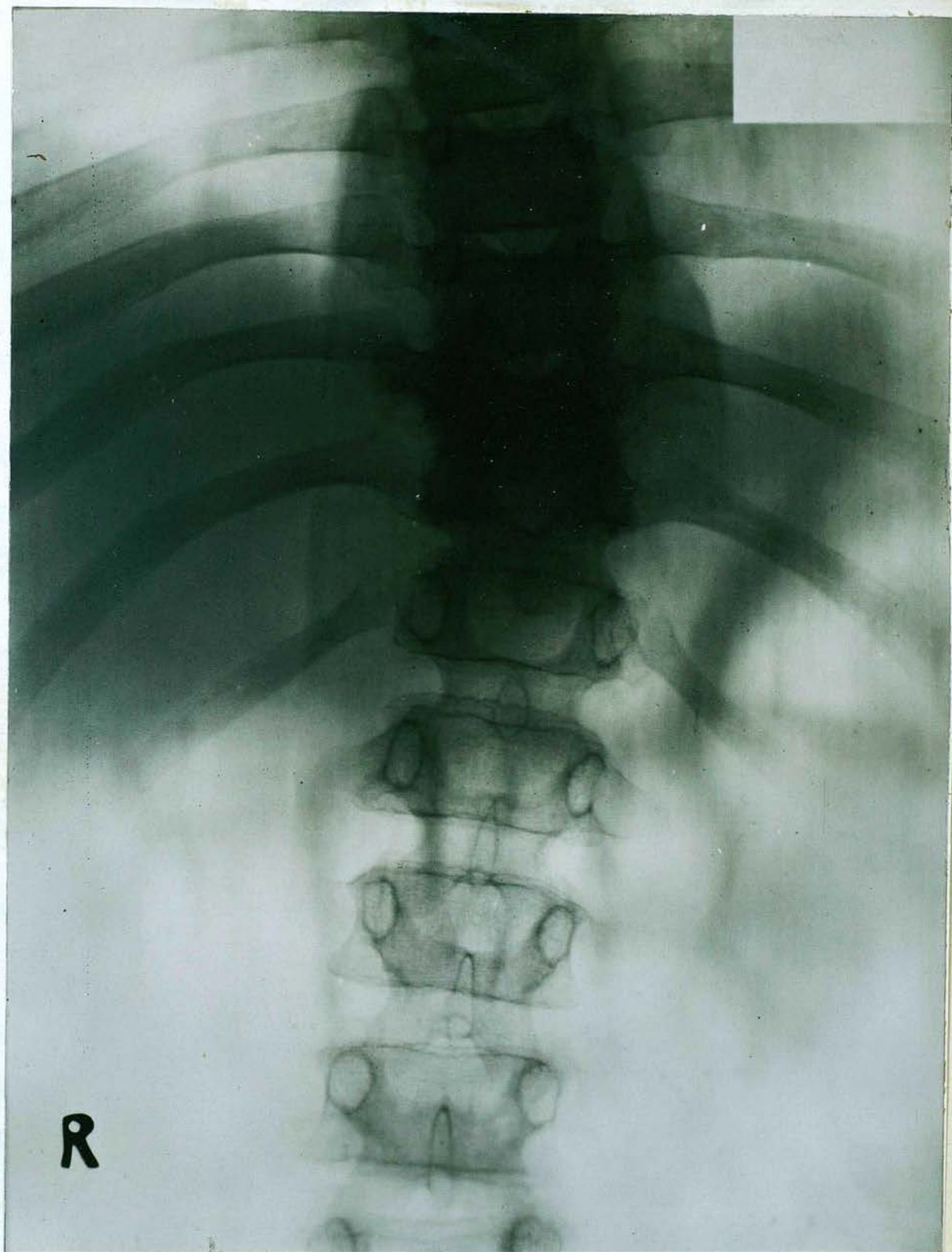
17/7/33. Radiogram shows disappearance of intense rarefaction at head of femur. Spine still shows large prevertebral abscess.

1/8/33. Position of hip keeps good in shell. Gibbus sharp.

Alexander McKinnon.

- (1) radiogram showing initial lesion in neck of femur.
Sclerosis is taking place around the focus.
- (2) Early picture of spinal lesion showing destruction of the 10th dorsal vertebra and adjacent discs, and large pre-vertebral abscess already passing below the diaphragm and tracking into the right psoas sheath.





CASE XIX.

First case of a series of four cases showing Pott's disease in the latter half of life. This case is complicated by iliac and gluteal abscesses.

William McGettigan. Age 59. Admitted 21/7/33.

Family History:-

His own parents lived to old age and were healthy. His wife has asthma. Two children born. Both are healthy.

Home Conditions:- Two apartment.

Previous Illnesses:-

He was never ill in his life until the present time.

History of Present Illness:-

He was working in the steelworks at Motherwell until the end of 1931. Then he had pains over the sacrum. He reported to his panel doctor and was treated for sciatica for six months. Thereafter he went back to work for a fortnight and had to give up on account of the pain. He remained more or less in bed until March of this year.

He has evidently been X-rayed three times, first in June 1932.

A swelling appeared on his left side about six weeks ago. He reported this to his doctor and was sent to the Victoria Infirmary where a diagnosis of Pott's disease was made.

Circulation:- Nil.

Respiration:-

He has been a miner but has had no chest trouble. Nothing on examination.

Alimentary Tract: No teeth: otherwise nothing to note.

Genito-urinary System:- Nil.

Nervous System:-

He says there has been intermittent tingling of the

feet during the past year.

Lymphatic Glands:- None markedly palpable.

Skin:- Clear.

Skeleton:- Nothing apart from lesion.

Von Pirquet Reaction:- Slightly positive.

Lesion:-

There is no gibbus. He has a large abscess above the iliac crest on the left side. There is also an abscess, the contents of which can be pushed from a compartment below the glutei to a compartment on the lateral aspect of the thigh about the level of the great trochanter of the femur. Whether the two abscesses communicate cannot at present be ascertained.

320 ccs. of pus were withdrawn from the lumbar abscess on admission and a sample injected into a guinea-pig. The skin was slightly reddened above the anterior superior spine but today (24/7/33) this reddening has gone.

Radiogram shows a lesion of the 4th and 5th lumbar vertebrae with complete destruction of the disc. The amount of destruction of the bodies cannot at present be determined as the radiogram is A.P.

Case Notes:-

1/8/33. The two abscesses were aspirated two days ago and a total of 375 ccs. pus withdrawn.

Poor radiogram of a case of tuberculosis of the fourth and fifth lumbar vertebrae.



CASE XX.

Second case of the series. Heavily built man who looked very unlike Pott's disease. Bad family history. Owing to obesity of patient, radiograms have been unsatisfactory for reproduction.

James D. Gray. Age 62. Occupation, baker.

Complaint: pain in the back.

Case taken: 13/4/33 (Western Infirmary).

History:-

Last July he became troubled with pain in the lower dorsal and upper lumbar regions when he lay on his back, or when he attempted to rise to a sitting or standing position. There was also pain when he walked. He was X-rayed on 8/2/33, and abnormality was discovered in the region of the 9th and 10th dorsal vertebrae.

He felt in excellent health apart from the pain. There has never been cough or spit. Sweating is not a feature, and no elevation of temperature has been noted. Weight is usually 14 st. 7 lbs., at present 13 st. 8 lbs. Condition has been considered to be rheumatic in nature, but had not responded to treatment.

Previous History:-

Four previous attacks of quinzy throat. Right-sided sciatica four years ago.

Family History:-

Father died aged 64 of Bright's disease. Mother died aged 80, old age. Wife died at 52 from cerebral haemorrhage. Two living children, one of whom has been in a sanatorium following pleurisy. One son died aged 35 of pulmonary tuberculosis. Two brothers died of phthisis when young men. Another brother died at age of 50 of abscess inside rectum.

General Examination:-

Patient is a heavily built, muscular man. He looks in good health. Has worn glasses for 30 years on account

of myopia. Mucous membranes well coloured. No cyanosis, jaundice or oedema. No enlargement of spleen or lymphatic glands. Examination of the back shows that there is tenderness on pressure over the spinous processes from the 8th to the 12th dorsal vertebrae.

The area of most acute tenderness and rigidity is about the 10th and 11th dorsal. There is also tenderness over the lower ribs on each side, particularly the right.

Cardio-vascular System:- B.P. 130/80. Nothing of note.

Respiratory System:-

Impairment of percussion note over the left side of the back. Respiratory murmur is diminished over the left side but is vesicular. Vocal resonance is also diminished. No rales.

Alimentary System:-

Pyorrhoea of lower teeth. Tonsils slightly hypertrophied. Long history of indigestion, possibly duodenal ulcer.

Genito-urinary System:- Normal.

Nervous System:- Normal.

X-ray Report:-

Bone disease is present at two of the dorsal vertebrae, probably the 9th and 10th, with loss of joint space between them, and some absorption of the bodies. In the A.P. view there is a suggestion of abscess formation. The appearances are those of tuberculous disease.

Wassermann Reaction:- Negative.

Case Notes:-

18/4/33. The pain is much worse on the right side than the left. The maximum appears to be on the right side from the 9th to the 10th intercostal spaces. There is slight tenderness there.

There is tenderness over the spine in the lower dorsal region, with rigidity of the surrounding muscles.

Pain began in the left side of the trunk and for a time was very severe. Later it spread to the right side, and recently there has been no left-sided pain.

19/4/33. Dismissed to go to Millport.

Since returning home, patient has been kept completely in bed, and there has been a marked improvement in his symptoms. Pain has become much less severe, and is practically absent when lying still.

18/5/33. Was admitted to Millport.

Lesion:-

The spine is rigid, especially in the lower dorsal region, but there is no prominence, which could be described as a gibbus.

There is some pain on percussion, but this is not very marked.

Radiogram shows a destructive bone lesion of the 9th and 10th dorsal vertebrae with the presence of a fusiform prevertebral abscess.

There is no external evidence of the abscess.

Treatment:- fixation in plaster shell.

1/7/33. The shell has abolished the pain from which he suffered, and, considering his age, he has settled down very well. The chances of healing the lesion at this age are small, but he can be made comfortable for ambulatory treatment in a celluloid corset when the fitting of this is indicated.

17/7/33. Has settled down well.

1/8/33. General condition definitely improved.

Original radiogram showing disease of the 9th and 10th dorsal vertebrae, with prevertebral abscess.

CASE XXI.

Third case of the series. Woman aged 66. Possibility of double lesion of spine.

Mrs. Mary Johnstone. Age 66.

Complaint:-

Pain in the back of several months' duration.

History:-

In the month of April 1932 patient began to complain of pain in the cervical and upper dorsal areas. The neck was held rigid, and the whole body was turned when she wished to look to the side. The pains radiated up to the head and towards the shoulders, and there was tenderness along the affected area.

The condition was considered to be rheumatic, and treated as such. She had a course of massage with some benefit.

In September 1932 she was X-rayed, and no abnormality was detected. Massage and electricity were recommended.

At the beginning of November 1932 she developed difficulty in swallowing, and was admitted to the Western Infirmary, Glasgow, on 15/11/32, suffering from a retro-pharyngeal abscess. This was opened under local anaesthesia.

Dr. Gavin Young's report suggested that the abscess probably arose from an old caseous tuberculous gland.

At the beginning of 1933 pain developed in the lower dorsal area, radiating to the front on the right side at the level of the gall bladder, and giving symptoms suggesting gall bladder inflammation.

As the pain persisted, and in view of the previous history, she was X-rayed in the Western Infirmary on 10/5/33.

Mr. Logan Taylor reported that there was very definite evidence of tuberculous disease of two of the lower dorsal vertebrae with irregularity of outline and evidence of bone absorption. This he thought to be a "flare-up" of an old tuberculous lesion.

12/5/33. Patient is a small, poorly developed woman who looks older than her years. She is dull and apathetic, and takes very little interest in her surroundings.

She is lying in bed, the whole spine seems to be held rigid, and, when she turns, her whole body is moved.

Examination of the back shows a marked deviation from the normal outline. There is an exaggeration of the natural stoop of old age, with marked rigidity of the spinal muscles. She complains of pain along the right side of the chest, and there is tenderness at the level of the 9th and 10th intercostal spaces.

There is also tenderness on pressure over the 9th and 10th dorsal spines.

Pain is not so severe now, since she has been kept completely in bed, but is still present on movement.

Previous History:-

She has always been troubled with rheumatism, and for the past 12 years has not enjoyed good health. There is a history of liver trouble years ago.

Family History:-

Father died of miner's lung, probably tuberculous. One sister died of pneumonia, influenzal in type.

Cardiovascular System:-

Blood Pressure 120/70. Heart sounds poor. "Tic-tac" rhythm. No murmurs.

Respiratory System:-

Chest rather barrel-shaped. Respiratory movement is diminished on both sides, but breathing is vesicular.

Alimentary System:-

Tongue raw but clean. Upper and lower dentures. No enlargement of liver nor evidence of carcinoma.

Appetite poor. Bowels constipated.

Genito-urinary System:- Normal.

Nervous System:- Normal.

Glandular System:- No enlarged glands.

10/5/33. Seen by Dr. Paul and transferred to Millport on 19/5/33.

Examination on Admission. Lesion:-

A small gibbus is present in the lower dorsal region due to prominence of the 10th dorsal spine. The movements of the spine are practically abolished. The whole spine is rigid and is moved en bloc.

There is a small indurated mass, non-fluctuant, just above the gluteal fold on the right.

Externally there is no other suggestion of abscess formation.

Radiogram shows a destructive bone lesion of the 10th dorsal vertebral body, the left half of the body being more extensively involved than the right.

A fusiform shadow seen in the film suggests the presence of a prevertebral abscess.

Treatment:- Recumbency in the dorsal decubitus. Owing to this patient's poor general condition, it was not thought advisable to immobilise her in a plaster shell, owing to the risk of development of hypostatic congestion.

1/7/33. There is slight general improvement, and the pain from which she suffered is much less. She eats and sleeps well, and appears to be quite happy.

17/7/33. Her condition appears to be unchanged.

1/8/33. In statu quo.

Mrs Mary Johnstone.

Radiogram showing pinching of disc between 9th and 10th dorsal vertebrae, with bone destruction on the left of the 10th body.



CASE XXII.

Fourth case of the series. Showed commencing paraplegia. Unfortunately he died of erysipelas before he could be transferred to Millport. No X-rays available.

Patrick Hampson. Age 50. Furnace worker.

Complaint: pain in the back between the shoulder blades.

Case taken: 14/12/31.

History:-

Patient first noticed pain in his back three to four months ago. This pain became worse as the day went on. Since first noticed, pain has gradually become more marked, and is especially felt when walking, moving about or getting a jolt.

It is very marked on going downstairs or on making any twisting movements of the spine. Occasionally he has pain travelling round to the front of the chest.

Previous History:-

Pneumonia four years ago. Two years ago was in hospital with suppuration of middle finger of right hand, leading to amputation. Health otherwise perfect.

Family History:- Nothing of note.

Condition on Examination:-

Well nourished. Colour good. Patient lies curled up on his side in bed. There is undue prominence of the 4th and 5th dorsal spines. He does not hold himself erect, being crouched slightly forwards. Marked rigidity of muscles round affected segment of spine.

Central Nervous System:-

Pupils equal. Reaction to light sluggish. Arm, knee and ankle jerks all slightly exaggerated. Plantar reflex flexor. Abdominal reflexes slightly exaggerated. Tenderness on pressure round left side of the chest at level of 4th intercostal space. Tenderness also on pressure over 4th and 5th dorsal spines.

X-ray Report.

Evidence of disease of 4th and 5th dorsal vertebrae, which are hazy and irregular in outline, especially at articular surfaces. Narrowing of intervertebral disc. Condition is very suggestive of tuberculous disease.

Cardiovascular System:- Nothing of note.

Alimentary System:- Teeth bad. Bowels constipated.

Respiratory System:- Normal.

Genito-urinary System:- Normal.

Lymphatic Glands:- Not enlarged.

Wassermann Reaction:- Negative.

Case Notes:-

31/12/31. Developed evidence of pressure on cord. Slight paresis of right leg. Knee jerks exaggerated. Ankle clonus present. No sensory disturbances.

1/1/32. Rise of temperature to 101°. Complains of pain and tightness over nose.

2/1/32. Temperature still elevated. Brawny swelling of nose, commencing to spread over cheeks.

3/1/32. Transferred to fever hospital suffering from erysipelas.

9/1/32. Symptoms of last few days of illness were more referable to the erysipelas than to the spinal lesion.

Latterly became delirious and developed complete retention of urine requiring regular catheterisation.

Arrangements had been made before onset of erysipelas for his transfer to Millport.

SUMMARY AND CONCLUSIONS.

(1) Tuberculosis of the spinal column is local evidence of pre-existing general infection. The influence of this conception on treatment is emphasised.

The mode of infection is discussed and the haematogenous route is favoured, but it is possible that the lymphatic route may also play a part.

Attention is drawn to recent researches into the detailed anatomy of the intervertebral disc. In view of these it is probable that in some cases the primary infection is in the disc.

(2) Attention is drawn to the fact that a large percentage of cases of spinal caries under the age of ten years is BOVINE in type, and the bearing of this on the preventive side of treatment is emphasised. It is insisted that a milk supply free from the infecting bacillus is essential.

(3) A case is described of the rare condition of tuberculosis of the SPINE of a vertebra.

(4) Recent investigations show that a small percentage of abscesses are sterile, due to the fact that the contained Bacilli are "dead". As a rule these do not refill after aspiration.

(5) Modern opinion inclines to the belief that a causal relationship between trauma and osseous tuberculosis is extraordinarily rare.

(6) It is emphasised that important points in the taking of radiograms are, (a) that the tube must be focussed directly over the affected disc, and (b) that a low penetration, (45 to 55 Kv.) should be used in children to obtain clear details of bone structure. Attention is drawn to the use of lipiodol in tracking sinuses and illustrative radiograms are given.

(7) A short description is given of Schmorl's researches on the anatomy of the intervertebral discs showing that spondylitis deformans juvenilis is due to prolapse of the nucleus pulposus rather than to abnormalities in growth of the so-called epiphyses.

(8) A description is given of a rare form of osteochondritis vertebralis at first treated as a case of Pott's disease.

(9) Pott's disease needs longer and more intensive treatment than is commonly thought. A long period of recumbency is necessary, and institutional treatment is considered essential.

(10) Details of the treatment of spinal tuberculosis as carried out in Saint Andrew's Home, Millport, are given.

(11) The advantages and disadvantages of nursing in the ventral and dorsal positions are discussed, and the technique followed in Millport is given in detail.

(12) The making of plaster half-shells and celluloid

corsets is described.

(13) The dangers of mixed infection after sinus formation are emphasised and the importance of dealing with the psoas abscess before it enters the thigh is stressed.

(14) The operative treatment of Pott's disease is considered. The conclusion is reached that it is practically never indicated in children, whilst in adults, it is only indicated very exceptionally. It must not be employed with a view to shortening the period of recumbency.

(15) A detailed description is given of cases personally studied, representative of the different sites affected and the different complications met with, in the treatment of Pott's disease.

-----oOo-----

BIBLIOGRAPHY

1. Pott's Disease of the Spine. D'Arcy Power. Brit. Journ.Surg., 11. 126. July 1923.
2. Companion to Manuals of Practical Anatomy, E.S. Jamieson, p.5.
3. Cunningham's Anatomy, p.87.
4. Tuberculosis of the Spinal Column, John Fraser. Edin.Med.Journ., March 1929. 133.
5. Untersuchungen über Knochenarterien, 1904.
6. Roentgen signs of Tuberculosis of the Vertebral Body. Doub and Badgley, American Journ. of Roentgenology and Radium Therapy, Vol.xxvii, p.827. June 1932.
7. Fraser, Journ.Exp.Med., 1913, xvii, p.362.
8. Steindler, Diseases and Deformities of the Spine and Thorax, pp.359, 365, 354, 356, 390, 391, 404.
9. Krause, Die Tuberkulose der Knochen und Gelenke. Deutsch Chir., No.28.
10. Rust. Arthrokakologie. Wien, 1817.
11. Richards. Suboccipital Pott's Disease. Am.Jour. Roentgen. 8, 632. November 1921.
12. Moore. Case of Spontaneous Fracture of Transverse Process of Lumbar Vertebra due to Tuberculosis. Jour.Bone and Joint Surg., 20, 322, 1922.
13. The Dictionary of Practical Medicine. Vol.III, p.231.

14. Bonnet and Menard. Etude pratique sur le mal de Pott. Masson, 1900.
15. Girdlestone, The Place of Operations for Spinal Fixation in the Treatment of Pott's Disease. Brit.Jour.Surg., 10, 372, 1923.
16. Cofield: Hypertrophic Bone Changes in Tuberculous Spondylitis. Jour.Bone and Joint Surg., 20, 322, 1922.
17. Ridlon: Rotatory Lateral Deformity of the Spine in Pott's Disease. Med.Rec., Sept.17, 1892.
18. Ridlon: Jean Pierre David: The Man who potted Pott. Boston Med.& Surg.Jour., Sept.7, 1916.
19. Olivier. Traité de la moelle epinière et de ses maladies. 1827.
20. Lannelongue. Tuberculose vertébrale. 1888.
21. Charcot. Leçons du Mardi. 1888-9. pp.180-181.
22. Madame Sorrel - Dejerine, Contribution à l'étude des paraplégies pottiques. Masson et Cie, 1926.
23. Peabody: Secondary foci of Spinal Tuberculosis in Pott's Disease. Ann.Surg., 1922, 75, 95.
24. Wullstein: Spondylitis und Spondylarthritits tuberculosa. Joachimsthal's Handbuch d.orth.Chir., I, 2, 1927, 1905-7.
25. Wallace: A Survey of the Occurrence of Compression Paralysis in Pott's Disease. Jour.Bone & Joint Surg. 6, 538, July 1924.
26. Dollinger: Die Behandlung der tuberkulösen Wirbelentzündung. Stuttgart, 1898.

27. Thomson and Miles: Manual of Surgery, Vol.II, p.121.
28. Choyce: **A.** System of Surgery. Vol.III, p.515.
29. Kofman: Early sign of Tuberculous Spondylitis in the Pregibbus Stage. Jour.Bone & Joint Surgery, 14, 143, January 1932.
30. Doub and Badgley: Tuberculosis of the Intervertebral Articulations. Amer.Jour.of Roentgenology and Radium Therapy. 1931, 25, 299-307.
31. Scheuerman H. Zeit.f.orth.Klin., 1921, p.41.
32. Leskinin: Acta Chir.Scandinavia. 15th August 1924, pp.57, 193.
33. Vulpius: Zur Statistik der Spondylitis. Arch. Klin.Chir., 58, 2.
34. Vacchelli: Le vie deflusso degli accessi ossifluenti. Chir.Org.Movim. 8, 1 and 244, 1924.
35. Ridlon: Differential Diagnosis and Prognosis of Pott's Disease. Chicago Med.Soc., and Colorado State Med.Soc., June 1896.
36. Ridlon: Diagnosis and Prognosis of Spondylitis. Colorado State Med. Soc., 1896.
37. Gibney: Jour.Nervous and Mental Dis., Jan 5, 1897.
38. Taylor and Lovett: Med.Rec., Vol.29, p.699.
39. The Influence of Koch's Discovery upon Surgery, with particular Reference to the Treatment of surgical tuberculosis.
Gauvain: Transactions of the National Association for the Prevention of Tuberculosis. 18, 29, 1932.

40. Calot: Treatment of Pott's Disease. Medical Press. 129. March 26th and April 2nd, 1930.
41. Campbell: Analysis of 51 Bone & Joint Affections treated by Heliotherapy. Jour.Orth.Surg., 15. 1. 1917.
42. Roederer: Treatment of Osteoarticular Tuberculosis by Heliotherapy. Paris Med., 13, 43, July 14, 1923.
43. Wilkinson: Some aspects of Treatment of Tuberculosis under the Metropolitan Asylums Board. Brit. Jour.of Tuberculosis. 24. April 1930.
44. Calot: Indispensable Orthopaedics (Trans. C.V. Mosby), St. Louis, 1915.
45. Valtancoli: La tubercolosi della colonna vertebrale. Chir.Org.Movim, 5, 127, 1921.
46. Menard: Traitement de la Paraplegie du Mal de Pott par la Drainage laterale. Rev.d'Orthop., 2, 1895.
47. Denk: Zur operativen Behandlung der tuberkulösen Spondylitis. Arch.Klin.Chir., 132, 156, 1924.
48. Thomson & Miles: Operative Surgery, p.213.
49. Girdlestone: The Operative Treatment of Pott's Paraplegia. Brit.Jour.Surg., 19, 121. July 1931.
50. Albee: The Bone Graft Operation for Tuberculosis of the Spine. Twenty Years' Experience. Jour. Amer. med.Assoc., 94, 1467, May 10th, 1930.
51. Wheeler, Sir W.I.de C.: Practitioner, November 1922.
52. Barnett: Orthopaedic Aspects of Surgical Tuberculosis. Brit.Jour.of Tuberculosis, 24, 122. July 1930.

53. Malkin: Bone Graft and Fusion Operations in Tuberculous Spondylitis. B.M.J., I, 5, January 2, 1932.
54. Wheeler, Sir W.I.de C.: Bone Grafting as Part of the Conservative Treatment in Advanced Cases of Pott's Caries. The Robert Jones Birthday Volume, p.325.
55. Max Flesch-Thebesius, Chirurgische Tuberkulose. B.M.J., June 24, 1933. p.1109.
56. Griffith and Summers: Human and Bovine Infections in Bone and Joint Tuberculosis. Lancet April 22nd, 1933, p.875.
57. The Intervertebral Discs. Observations on their normal and morbid Anatomy in relation to certain Spinal Deformities. Beadle. Med.Research Council, 1931, pp.23, 63.
58. N.Ross Smith; Intervertebral Discs. Brit.Jour. Surg., 1931, 18, 358-375.

-----oOo-----